The Electrical Industry's Weekly Magazine

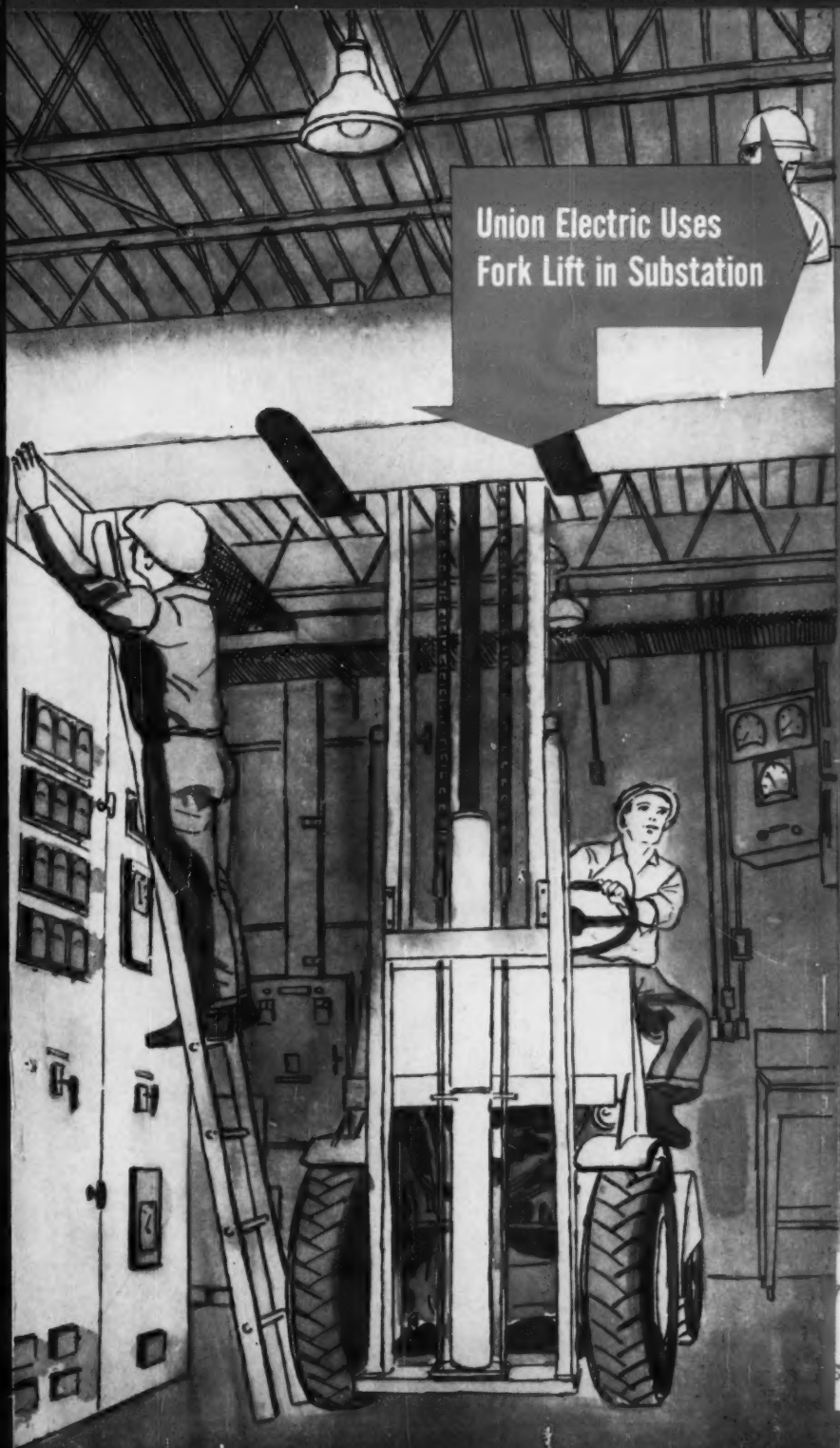
June 27, 1960

Electrical World

Price One Dollar

A McGraw-Hill Publication

Third of six reports for 1960



Union Electric Uses Fork Lift in Substation

Starts on p 65

Data logger monitors 400 points on three units for Florida Power Corp

Renovated factory gives Detroit Edison an efficient warehouse-service center

Departments:

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UNIV MICROFILMS INC
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ANN ARBOR MICH

General Electric reports on developments in . . . **NUCLEAR POWER**

Coming Closer: ECONOMICAL NUCLEAR POWER

FIVE YEARS AGO General Electric established its Atomic Power Equipment Department to consolidate the Company's work on commercial applications of nuclear energy. After three years of research and development, the Department set two closely related goals of interest to electric utilities:

- continued improvement of the boiling water reactor, which General Electric research had shown to be the reactor type most likely to bring economical nuclear power fastest, and at least cost
- attainment of competitive nuclear power in high-fuel-cost areas by 1965

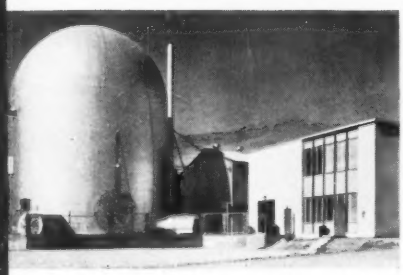
IN APRIL 1960 an important event symbolized the rapid progress made toward the first goal. Commonwealth Edison's Dresden station, the nation's largest all-nuclear power plant, produced its first power for the Chicago area. Boiling water reactor technology has been advanced considerably by design, construction, and test experience at Dresden.

DURING THE NEXT FEW YEARS a series of boiling water reactor power plants will be constructed, each making a significant contribution to the attainment of the second goal, competitive nuclear power. These plants are part of Operation Sunrise, a General Electric technical development program which has already resulted in several innovations with significant cost-cutting potential:

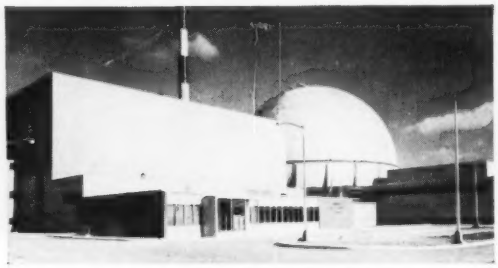
- **Pressure suppression,** which eliminates the need for large spherical containment vessels in some applications
- **Nuclear superheat,** which results in an improved heat rate
- **Internal steam separation,** which eliminates the need for high steam drums and extensive piping

Two 50,000-kw Operation Sunrise plants will be completed by 1962—Pacific Gas & Electric Company's Humboldt Bay station and Consumers Power Company's Big Rock plant. Operating experience gained from these and other evolutionary plants, as well as from Dresden and from General Electric's Vallecitos Boiling Water Reactor, will help cut the cost of nuclear power further.

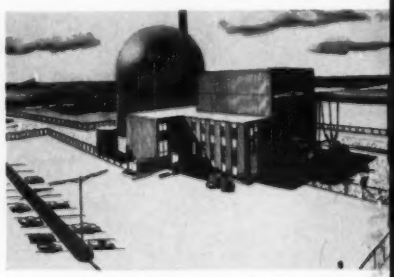
IN THE 1970'S nuclear fuel will achieve conventional status throughout the United States. The co-operation of electric utilities, the Government, and manufacturers toward this end is an indication of a progressive attitude toward technological development, an attitude which will help this country maintain its international prestige and security. For more information on Operation Sunrise, write for publication GED-3750, General Electric Company, Section 604-05, Schenectady 5, N. Y.



THE VALLECITOS BOILING WATER REACTOR is part of G.E.'s Vallecitos Atomic Laboratory, the world's largest privately owned nuclear laboratory.



COMMONWEALTH EDISON'S 180,000-kw Dresden station, the nation's largest all-nuclear power plant, began supplying power in April, 1960.



TO BE COMPLETED IN 1962, this plant of Consumers Power Company will contribute to a rapidly growing boiling water reactor technology.

GENERAL ELECTRIC

Electrical World

Vol. 153, No. 26 JUNE 27, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

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Swedish Underground Steam Plant on the Line

First 150-Mw unit is operating in subterranean plant near Gothenburg, ultimate capacity to be 700 Mw.....p 42

GENERATION

Natural Steam Source Harnessed

A. W. Bruce, Pacific Gas & Electric Co

Geysers in California become energy source for PG&E's 12.5-Mw turbine-generator—first such project in US.....p 46

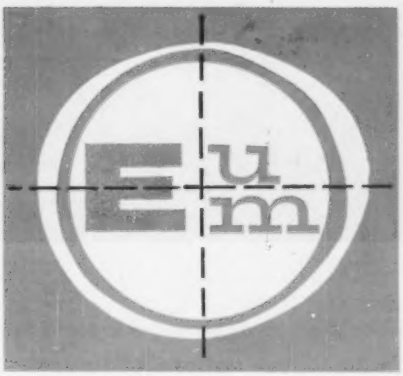
TRANSMISSION

Series Capacitors More Promising

S. B. Crary, General Electric Co

Longer transmission, higher right-of-way costs call for their wider use; will compete with coal transport.....p 44

Special Report



Electric Utility Methods

New devices for better performance, plus new uses for proven tools and equipment, are presented in the third of six reports in 1960 for those working in utility construction, operation or maintenance. Almost a score of methods are detailed in this 70-page report.

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Fork-Lift Truck Speeds Substation Installation.....p 82
Recorder Monitors 400 Points on Three Units.....p 84
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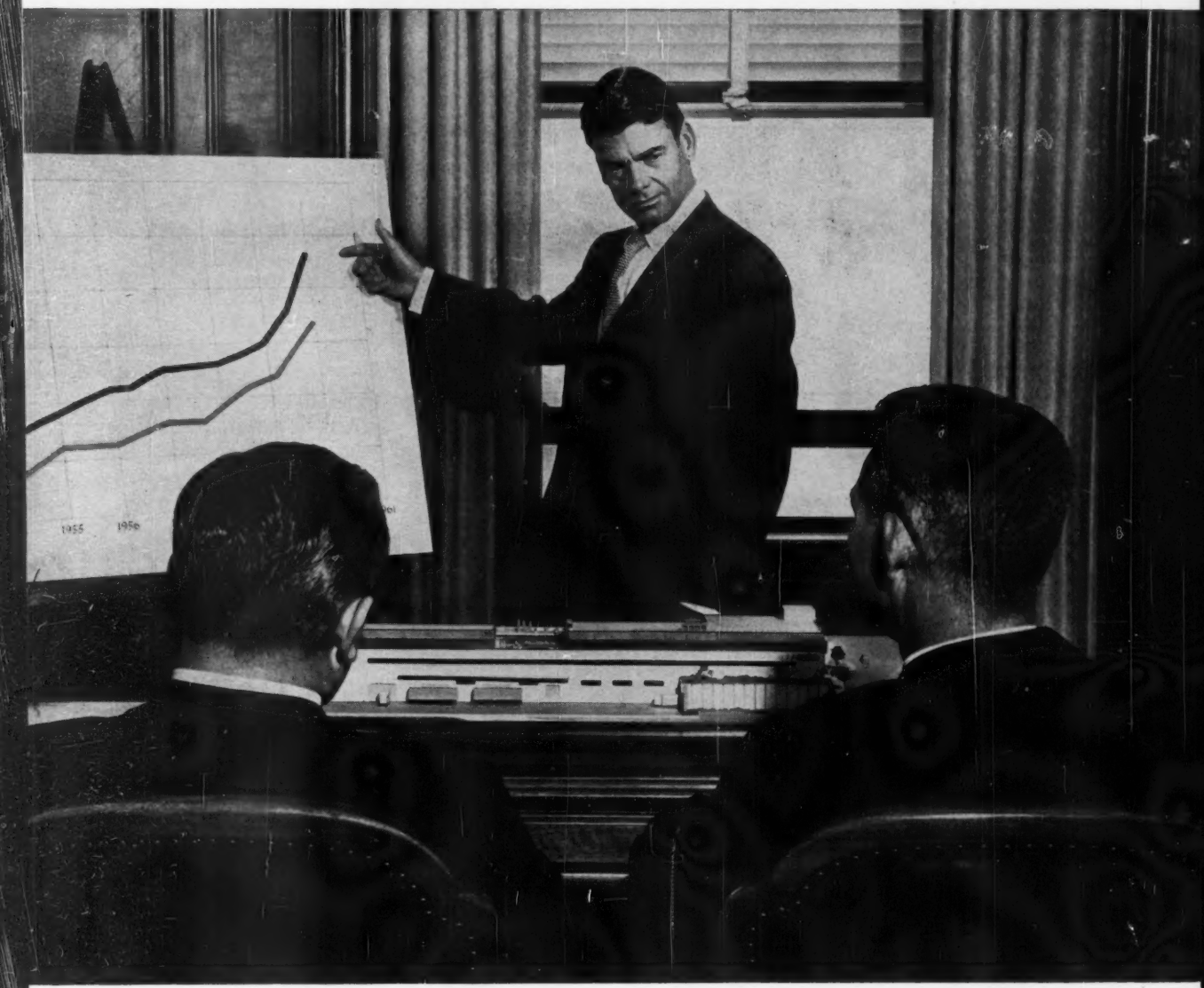
Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...



Profitability? Faced with the decision to expand your plant facilities, you should first determine whether all elements combine to form a pattern of future profitability. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers designs and builds all types of power plants—steam-electric, gas turbine, combined cycle, nuclear and hydro-electric. From Pre-Engineering through design and construction, Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

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LETTERS

Slogan for the Sixties

To the Editor:

I agree that the advent of the 1960s introduces an era of unlimited potential for both the electrical utility and the electrical equipment manufacturing concerns. Quantity and quality of service and merchandise will be bigger and better than ever before and I think, as does Mr. Sorenson (EW, April 11, p 5), that this fact can be impressed on the mind of the main beneficiary—the customer—by a properly directed slogan.

I respectfully submit: *"The 'Power-full' Sixties!"*

James J. McBrearty
Pennsylvania Power & Light Co
Hazleton, Pa.

Why NOT Call It Demand?

To the Editor:

In reading Mr. C. K. Lewis' letter of the Bechtel Corp (EW, June 6, p 5) wherein he suggests finding a new word for "demand," it left me wondering why we should attempt to change a word that serves so well.

If Mr. Lewis has ever been in a power plant or a load dispatching center to watch the demand meter climb to new highs during heat storms, I am certain he would feel the full impact of the word "demand."

To me it brings to mind all those humming air conditioners "demanding" more current. What word could be more fitting to describe the situation when you are personally responsible to the public for keeping your plant facilities adequate.

Those humming air conditioners are the collective public fist that pounds on your 'demand' meter and shouts, "More." Isn't that demand? Is a kilowatt by another name still not a kilowatt?

H. G. Thayer, Supt
Geneseo Municipal Utilities
Geneseo, Ill.

Or Call It HORSEPOWER

To the Editor:

It appears to me that comments so far on the use of the word "demand" have not stressed the real meaning, namely "power."

That being the situation, why not use a term which nearly everyone is familiar with, namely, "horsepower."

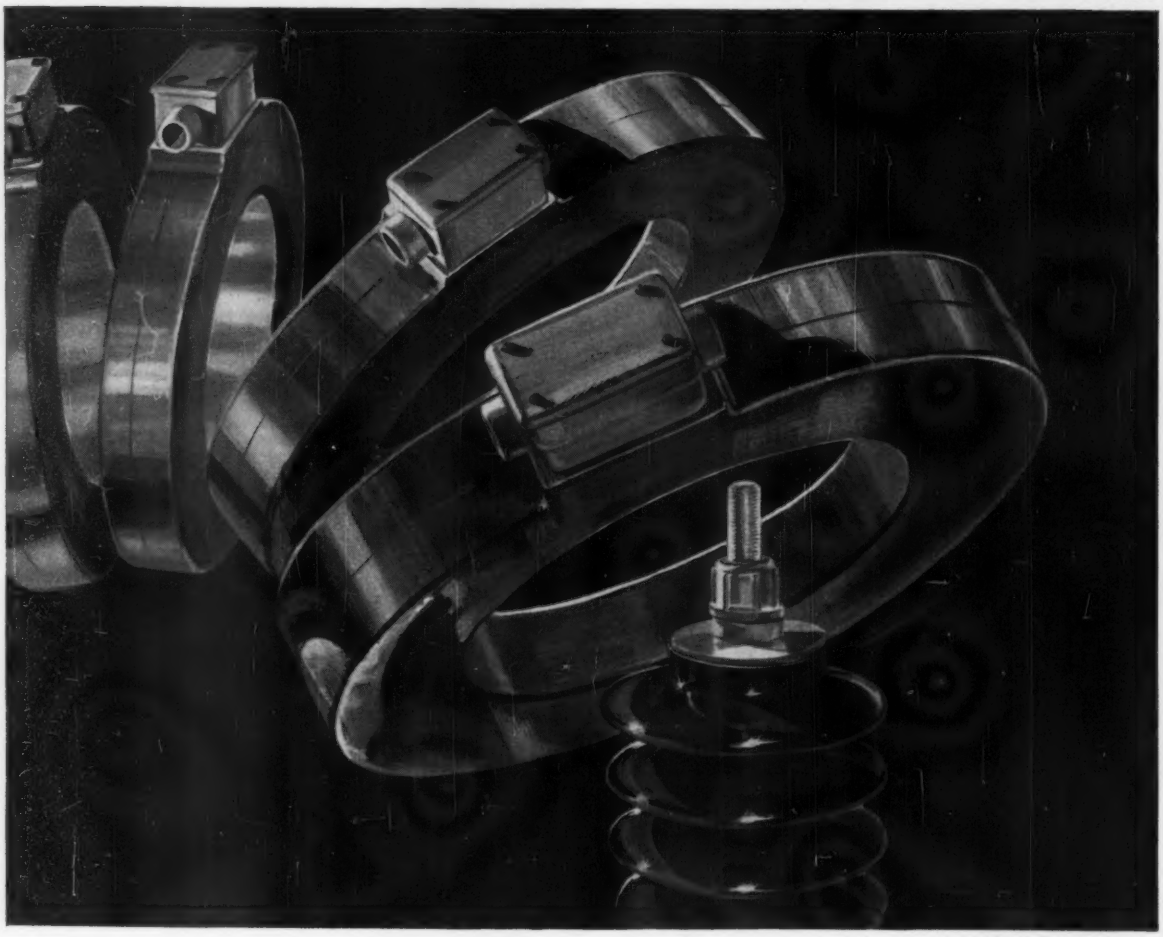
Our Canadian friends have used it for a long time, so why do we not adopt it also? . . . .

The use of "horsepower" will eliminate the use of the word, "demand" and so should contribute to a better understanding and better public relations everywhere.

R. R. Herrmann
1357 Raymond Ave
St. Paul 8, Minn.

ALLIS-CHALMERS

A-1300



Versaformer is an Allis-Chalmers trademark.

New Versaformer current transformer

installs as easily as tossing rings

Cuts installation time from days to minutes! New *Versaformer* current transformer, for indicating, relaying and protective functions, eliminates untanking and bushing removal with circuit breakers and power transformers. Ends the need for large installation crews and equipment.

Epoxy-resin encased *Versaformer* unit is completely weatherproof! Resistant to salt or acid atmosphere. Never needs painting. The complete *Versaformer* current transformer package includes a junction box for immediate conduit hook-up. Sizes: from 400/5 through 1200/5 amps. (Relaying accuracy: 10L200 for 400/5-amp rating.)

Get all the facts fast! Contact your nearby A-C office or **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wis.

Hook up new Versaformer current transformer without removing power transformer or circuit breaker bushings or covers. Available in 12, 16 and 20-inch inside diameters; rugged epoxy-resin case withstands wide temperature variations, severe mechanical shocks.

You can save money on crew time with Graybar as your auxiliary warehouse

On a single Graybar order, you can enter all the materials you need for, let's say, a complete distribution line project . . . and you will receive every item on schedule. Starts need not be delayed for lack of materials if Graybar is your auxiliary warehouse.

When the unexpected happens . . . emergency requirements . . . additional fill-in items . . . special tools . . . call Graybar. We are geared to handle the unusual. Even on large transmission line projects, we furnish prefabricated crossarm assemblies . . . another time-saving specialty of Graybar.

Start with a local call . . . Call in your local Graybar man and talk it over with him.

Employee-owned Graybar has been "on the line" and part of the local scene for years. Whether you require 3 items or 3,000, Graybar is your most practical source for most utility electrical equipment and supplies.

When Graybar is your auxiliary warehouse –	You save on storeroom costs Reduce inventory investment Insure prompt delivery Step up man-hour efficiency Simplify bookkeeping

935

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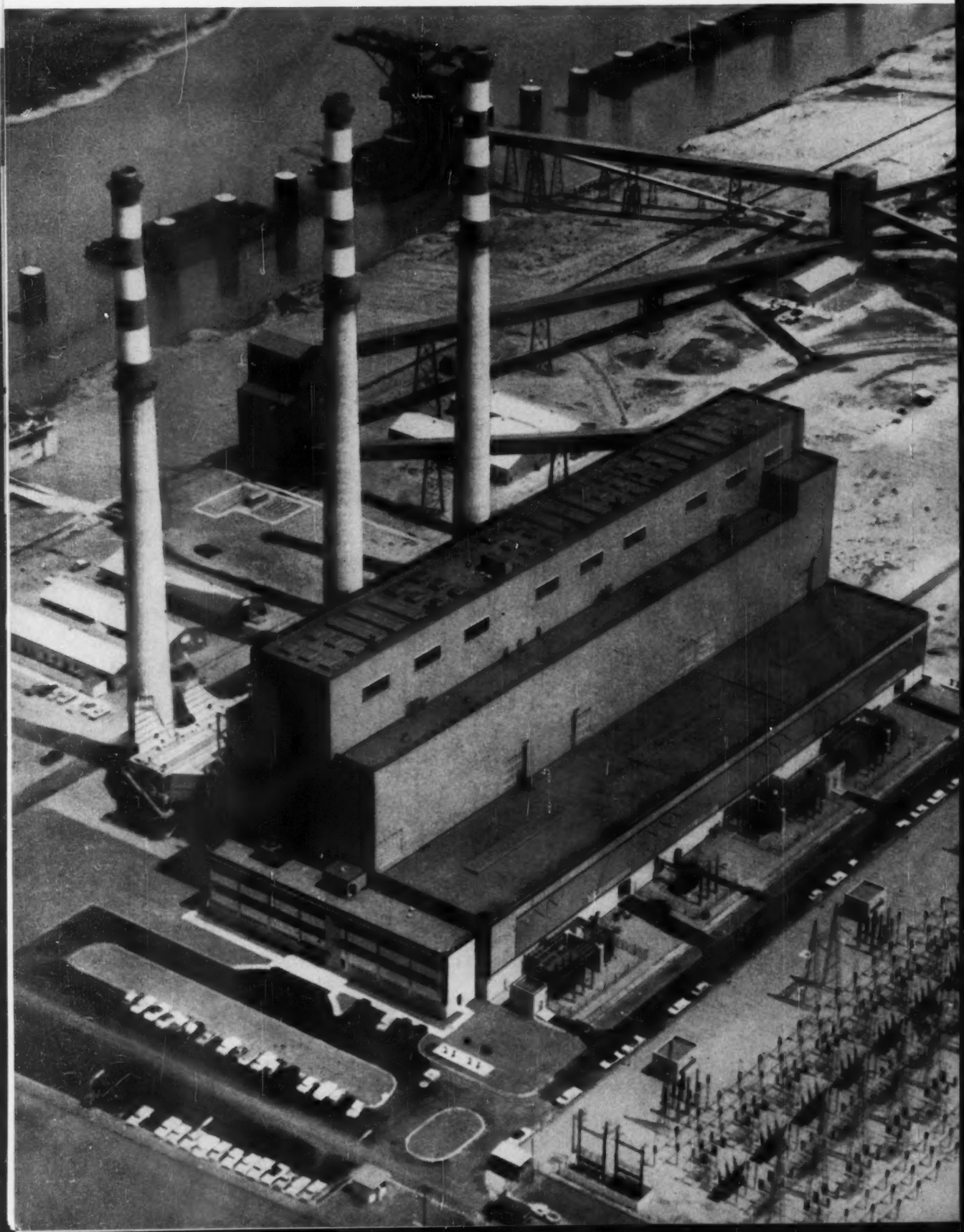
Thos. H. Allen Electric Generating Station,

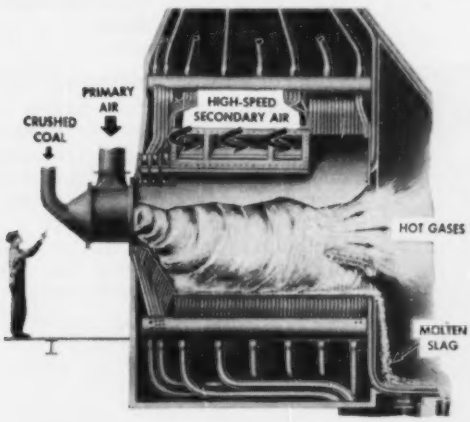


Memphis, Tennessee . . . 6 Million lb of Steam per hr

CONDITIONS:	
PRESSURE (TURBINE THROTTLE)	2400 psi plus overpressure
CIRCULATION	Natural Circulation
TEMPERATURE	1053F/1053F
FIRING	Cyclone Furnace
OTHER FEATURES	Gas Tempering

Natural circulation is self stabilizing over varied operation conditions at pressures of 2400 psi and higher—cuts boiler maintenance—no power loss to circulating pumps.

November, 1959, saw the third 2 million lb natural circulation boiler on the line in the Thos. H. Allen Electric Generating Station of Memphis, Tennessee. Although normally operated with 2400 psi at the turbine throttle, these units are capable, by design, of peaking operation at overpressure conditions for maximum kilowatt output as evidenced by actual test results. These units again demonstrate the advantages of natural circulation at the higher operating pressures and temperatures necessary for maximum power generating efficiency. Burning some 300 tons of West Kentucky coal hourly in 21 B&W Cyclone furnaces, the station has a net generating capacity of 812,500 Kw.



Cross section view of a B&W Cyclone Furnace. Molten slag holds coal and ash permitting rotary air motion to "wash out" maximum BTUs, and reducing ash in boiler and convection passes. The Cyclone Furnace handles a wider range of coals, especially in the lower grades, and helps reduce fuel-costs and ash handling in power stations across the nation.

Use of natural circulation—which is self-stabilizing under conditions of sudden overload and fluctuations in firing—is possible in the high pressure, high temperature range through B&W's development of the Cyclone Steam Separator. It is this device that provides the steam free head of water for efficient functioning of the natural circulation system. With Cyclone Steam Separators, boilers functioning at the throttle pressures of 2400 psi and higher, provide more efficient operation plus operating and capital economies—factors underscored by carefully considered utility choice.

The City of Memphis' Thos. H. Allen installation is representative of advanced steam generating stations across the nation. Utilizing such B&W design advantages as natural circulation, the Cyclone Steam Separator, the Cyclone Furnace, and gas tempering—these stations are helping to meet the surging needs for electric power.

In planning system expansion, B&W can talk your language in terms of efficiency and future operating economies. You'll find B&W sales engineers ready to work with you at every stage of your planning. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

G-961-CS

B&W

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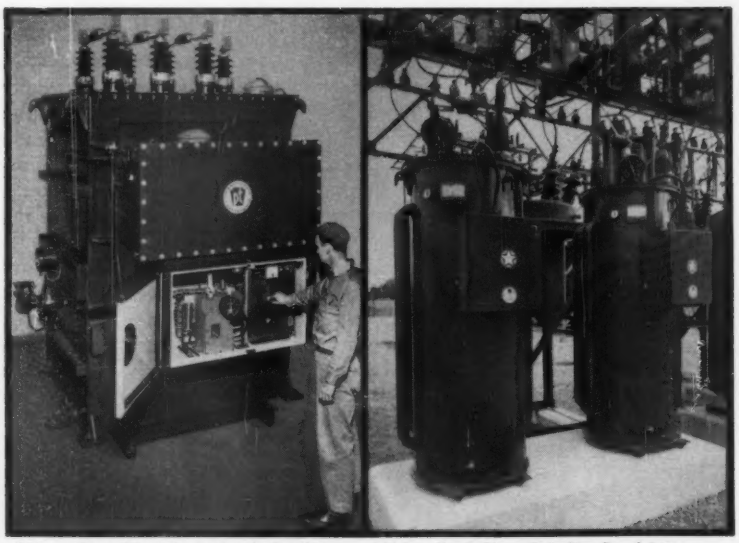
BOILER DIVISION

in both single- and three-phase regulators...

CONTROLLED SPEED of Pennsylvania Direct-Drive Tap Changer gives you

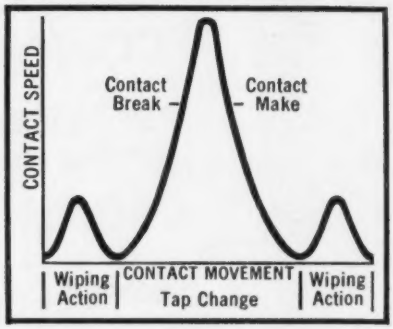
- **MINIMUM CONTACT EROSION**
- **QUIET OPERATION WITHOUT MECHANICAL SHOCK**
- **LONG-RANGE UNIFORMITY OF OPERATION**



750-kva Three-Phase Pennsylvania Regulator 125-kva Single-Phase Pole Star Regulators

Recent introduction of Pennsylvania's single-phase Pole Star Regulator means that utilities can now obtain 32-step regulation with a direct-drive tap changer in *both* single- and three-phase step voltage regulators.

The following curve illustrates some of the principal advantages of Pennsylvania's direct-drive mechanism:



Both the speed and movement of the contacts are carefully controlled by means of scroll-cam, geneva-gear operation. First, a preliminary wiping movement positions the contacts for the tap change. The contact *break* then occurs during *rapid acceleration* . . . but an equally rapid *deceleration* occurs before the contacts are re-engaged. After a momentary pause, contacts move to their final position with a slow wiping action that has a self-cleaning effect.

This controlled speed minimizes arcing at both ends of the tap change . . . particularly at completion of the tap change, where the slower speed *eliminates arc-producing contact bounce.* Reduced arcing has the double effect of lessening both contact erosion and oil deterioration.

Other advantages of the direct-drive tap changer include *long-range uniformity* of speed and positioning, and *quiet operation, without mechanical shock.*

Want to arrange a demonstration?

If you have not already done so, why not personally inspect Pennsylvania's direct-drive tap changer? Demonstrations for engineering and purchasing personnel can be arranged by writing to Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW-EDISON

Pennsylvania Step Voltage Regulators

PENNSYLVANIA TRANSFORMERS

The Electrical Week

LATE NEWS ▶ **Rates** . . . Pennsylvania's two largest electric companies are drawn into the sweeping rate investigation by the PUC. Philadelphia Electric and Pennsylvania P&L ordered to show cause why there should be no reduction in rates. Of nine smaller companies originally included, Harvey's Lake Light Co is first to agree to reduce rates.

At AIEE in Atlantic City . . . Incoming Pres C. H. Linder is "pinned" by Pres J. H. Foote . . . Westinghouse's L. A. Kilgore gets Lamme medal . . . Delegation tours Eddystone Plant of Philadelphia Electric, sees first supercritical unit operating at or near full capacity.

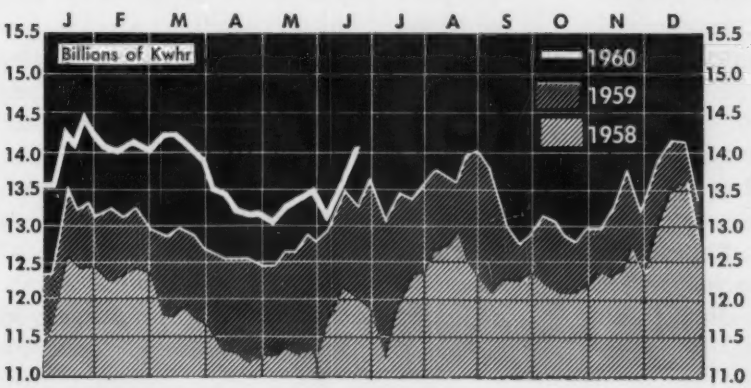
Atom Items . . . Nuclear power plant of Carolinas Virginia Nuclear Power Associates will be built by Daniel Construction Co of Greenville, S. C. The 17,000-kw plant will be finished in 1962 . . . Congress will be asked for Hanford Works generation funds in next session.

Around the states . . . Fishery agencies of Oregon, Washington, and Idaho announce preference for High Mountain Sheep over Nez Perce . . . Rochester G&E is negotiating for 200,000-kw of Niagara power. This is about half of total steam generation capacity of utility . . . Ohio Power Co settles with UWUA for 4% wage increase effective June 1 . . . US and Canadian negotiating teams will discuss Columbia development at Ottawa July 9.

Washington Wire . . . Senate Democrats refuse to okay Eisenhower appointees to the FPC and FTC. Nominations of P. A. Sweeney and T. J. Donegan to FPC and E W. Kinter to FTC are pigeonholed for rest of session. President will be forced to give recess appointments after adjournment, then next president will make his choice.

Management Changes . . . Northern States Power promotes W. N. Marx to vp operations . . . J. C. Gibbs becomes senior vp, Citizens Utilities Co. J. E. Griffin is new vp and treasurer, and Ishier Jacobson to vp.

WEEKLY POWER OUTPUT–UP 5.4% (Week ending June 18), Kwhr 14,053,000,000



Per Cent Change From Previous Year

	June 4	June 11	June 18
Total U. S.....	+ 0.9	+ 1.9	+ 5.4
New Eng.	− 1.8	− 0.1	+ 3.8
Mid. Atlan.....	− 2.0	− 1.7	+10.3
Cent. Ind.	− 4.0	− 3.0	+ 1.8
West Cent.....	+ 0.4	− 0.8	− 0.7
Southeast	+ 3.6	+ 3.6	+ 5.3
South Cent. ...	+ 7.0	+10.8	+ 5.2
Rocky Mount...	+ 7.2	+ 7.9	+ 5.4
Pacific			
NW	+ 4.2	+ 3.6	+10.8
SW	+ 5.7	+ 8.9	+ 9.9

Seasonally Adjusted Index 268.0

Week ago 269.2 Year Ago 258.3

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **Who's buying Mexican Light & Power Co?** The answer lies behind a labyrinth of stock purchasing which "looks like something from Gilbert & Sullivan." The buying route lies through "Lichtenstein," London, New York, Central America, Hong Kong—and, of course, Mexico City. Follow it on **page 38** . . . A rider on a bill awaiting the President's signature would give Curecanti and other projects a lower interest rate on Treasury money **(p 39)** . . . Dan Braymer reports Germany asks for A-plant bids **(p 40)** . . . Chilean utilities repair earthquake damage **(p 41)** . . . Big Swedish underground steam plant goes on the line **(p 42).**

ENGINEERING ▶ **Series capacitors allow longer transmission** and cut right-of-way costs **(p 44)** . . . Steam from California geysers has been harnessed to a 12.5-Mw turbine-generator to produce power commercially by Pacific G&E. This is the first time this has been done in the US **(p 46).**

ELECTRIC UTILITY METHODS REPORT ▶ **Featured in the third EUM report for 1960:** Fork-lift truck speeds up handling of material and equipment in building Union Electric substation **(p 82)** . . . Operations recorder will monitor 400 points on three units for Florida Power Corp **(p 84)** . . . Detroit Edison converts old factory building into an efficient warehouse and service center **(p 86)** . . . Other utility methods detail tools and equipment of in-

Politics and Public Power

BILLS IN A 'WILL'

A dying Congress—still hoping for an early July adjournment—seems certain to take its last breath with action on a number of important bills left unspecified in its "will."

A number of these bills are themselves already dead, for lack of time to consider them. Others are very close to final consideration, but each passing day without action shaves their chances. A rundown of some of the more important of these measures, and possible Congressional treatment of them in its "will," follows:

• **Burns Creek**—The bill to create the controversial Idaho reclamation dam (98% of cost allocated to power) is treading water in a House Interior subcommittee. Reportedly, backers may try for passage next year rather than stir up adverse publicity during this election year. B—C's high percent of power, and low percent of irrigation, worries some Democrats who usually support federal projects. The House Interior subcommittee holds an executive session on bill today (June 27).

• **Bonneville-California Intertie**—The Senate Interior Committee last week asked Interior Secy Seaton to defer execution of a contract between BPA and Pacific G&E calling for a 230-kv line to send surplus Bonneville power to California. Interior can sign the contract, but isn't likely to do so for political reasons. The committee wants to delay until California's Gov Brown gets his study in final form. In its preliminary form, the governor's study recommended twin 500-kv federally built lines. The delay, if granted, will give Brown time to promote his study while the 230-kv one hangs in limbo.

• **Fryingpan-Arkansas**—Hearings were held on this 15-year old, 150-Mw, $170-million,

terest to readers in construction, operations, maintenance, stores and shops. New equipment begins on **page 67.**

PROCUREMENT & PRODUCTS ▶ **GE's medium transformer dept cuts list prices 4% on units 2,000-7,500 kva . . . TVA Chairman Herbert Vogel claims competition has been stimulated by the Authority's turning to foreign equipment makers and resisting "collusive bidding" (p 58) . . . Westinghouse labels as successful its two experiments in which the heat of fission inside a nuclear reactor was converted directly to electricity (p 60).**

MANAGEMENT ▶ **You can stretch your drafting-room dollars** by: (1) Motivating for improved performance; (2) Shifting routine design work from the engineer to the draftsman; and (3) Carefully selecting and training high-school graduates. For these and other views at a recent drafting room management conference, please turn to **page 137.**

SELLING ▶ **California town makes its street lighting brighter than any other in the state after discovering the savings in life and property afforded through accident reduction (p 142).**

NEXT WEEK ▶ **Read about new methods of obtaining economical peaking capacity.**

west-to-east slope water storage project by House Interior Committee "just to bring us up to date on new plans." Outlook: No enactment this year; look for it again in '61.

• **Stream Benefits**—Four bills are involved here. The first, a **Downstream Benefits bill** (HR-7201), would end the "one-way street" whereby only downstream non-federal dams must pay to any upstream reservoir for benefits they receive in added power output resulting from improved stream flow. Downstream federal dams are now exempt. The bill will be considered on the floor of the House this week. If approved, Senate passage is given a 50-50 chance (Story on p 148). The second and third of these bills concern **fish studies.** Both, now before the Senate Commerce Committee, appeared sidetracked. One calls for a comprehensive study of all Northwest streams in which migratory fish pose a problem to high dams; another, a stronger bill, would halt any dam construction across the Salmon River until fish facilities are improved. The fourth bill would permit up to 10% of federal multi-purpose projects to be charged off to **recreation.** Federal power supporters view this bill as an added means of splitting the cost of federal projects, thereby making them more economically feasible.

• **Business Expense Tax Deductibility**—A bill (HR-7123) allowing the deduction, for tax purposes, of certain expenditures in connection with business expressing its views on legislation directly affecting it, has been approved by the House Ways & Means Committee. (See story on p 38.)

These, then, are some of the more important power matters on 86th Congress' collective mind during its last days. The effects of their treatment in its "will" may be with us long after it has passed away.

Nuclear Notes

British atomic energy program will be cut back to between 3,000 and 4,000 Mw. In its latest white paper, the Atomic Energy Authority announces a halving of the number of power plants to six or seven and of the budget to $1,200 million under the original program. Main cause is the same as that for the falling off of interest on the continent: plenty of fossil fuel. Second reason is failure of power demand to meet expectations.

Safety of the proposed Peach Bottom, Pa., helium-cooled nuclear plant was pointed out to officials of several Maryland state agencies. Philadelphia Electric and AEC speakers appeared at a meeting in the Maryland capital to calm jitters caused by the nearness of the site to Maryland (EW, May 30, p16).

Cleanup costs after the April incident in the Westinghouse Test Reactor are running over $100,000. To hold waste water used in cleaning up, the company has had to install more than 30 tanks of 20,000-gal capacity each at the Waltz Mill, Pa., site.

Another radiation incident, which occurred at Oak Ridge on April 26, exposed eight persons who were immediately in front of an operating cell, where a remotely operated saw was cutting an irradiated fuel element. No one was seriously injured, however. One man received slightly more than 2 rem to the lungs and to the bone and others got internal exposure from ½ to 1 rem. The maximum permissible annual dose to lungs is 15 rem and to bone, 30 rem. Exposure of 104 others then in the building was negligible.

An Atomic Energy Act amendment proposed by the AEC would eliminate government indemnity liability for damage on the property of licensed private reactor owners. Purpose is to reserve government liability of a half a million dollars for indemnification of the public, while damage at reactor sites should be covered by commercial insurance. The government funds will still cover AEC contract activities under the amendment.

India's H. J. Bhabha has all but concluded a deal for Russian help in building one of two proposed 150-Mw natural-uranium plants. Because New Delhi requires 50-75% of the equipment to be fabricated in India, Moscow is offering design and construction assistance and training for Indian technicians in the Soviet Union, plus easy credit terms. Bhabha, chairman of India's AEC and a prominent nuclear physicist, will ask for world bids on the second plant and expects proposals from the U. S., Britain and France. Plans are to have one of the plants in operation by the end of 1964. The Indians are also planning two enriched-uranium plants, one of 75-100 Mw, the other in the 25-50-Mw range.

Herman O. Stoelting, Development Engineer and well known authority on lightning protection, exhibits L-M's line of distribution lightning arresters. L-M offers the most complete line. Type E distribution arresters from 1 through 20 kv; Type SS high voltage distribution arresters in 27 and 30 kv; open gap Type TX arresters from 3 to 18 kv. The line includes some ratings not generally offered, such as 20, 27, and 30 kv.

L-M Offers Most Complete Line Of Distribution Lightning Arresters

Line Material, long a leader in lightning arrester development, recognizes the importance of proper arrester application. Arresters rated lower than the actual voltage requirements can be a frequent cause of trouble. Failure to consider system overvoltages and unbalance can result in arrester failure.

Line Material therefore offers a complete line, that permits the distribution engineer to make more accurate selection of the proper arrester to meet the requirements of the specific system, voltage, and location.

Get Details on Arrester Ratings, Features, Application

Ask the L-M Field Engineer for information on L-M Arresters and application data; or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13.

FOUR OUTSTANDING BENEFITS FROM USING L-M ARRESTERS

1. Long life; durability equalling station arrester standards, because of the characteristic element, plus lens electrodes in the element, and superlative moisture sealing.

2. Excellent protection of associated equipment; low impulse sparkover; high discharge capacity; generous margin of protection for transformer BIL. This has been proved by 20 years of field experience with some 2½ million L-M arresters now in service.

3. Prevention of line lockout by the L-M-originated Isolator (or external gap on Type TX). The Isolator was an L-M "first"—a vital contribution to the industry. The L-M Isolator has definite dependable time-current characteristics to permit accurate coordination.

4. Fewer operations of, and less wear on, sectionalizing equipment. With high follow currents, reclosers operate more frequently. L-M valve arresters have very low follow current due to the design, and back-up reclosers are called on to operate much less frequently.

LM

LINE MATERIAL®
Industries

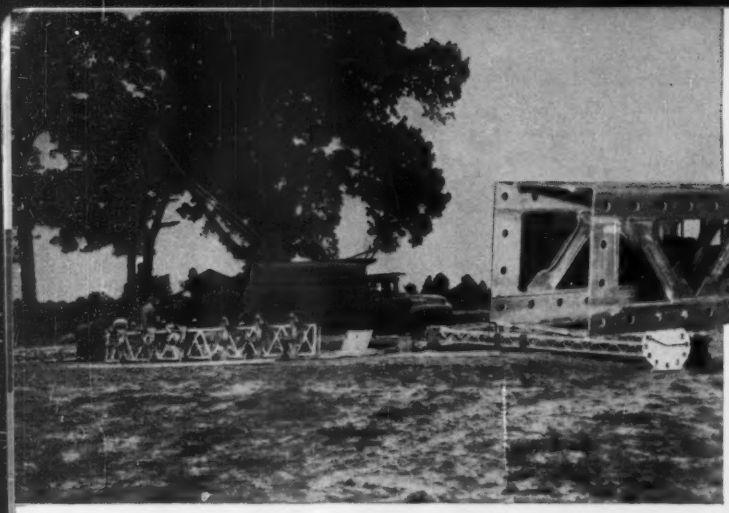
McGRAW-EDISON COMPANY

Lightning Arresters

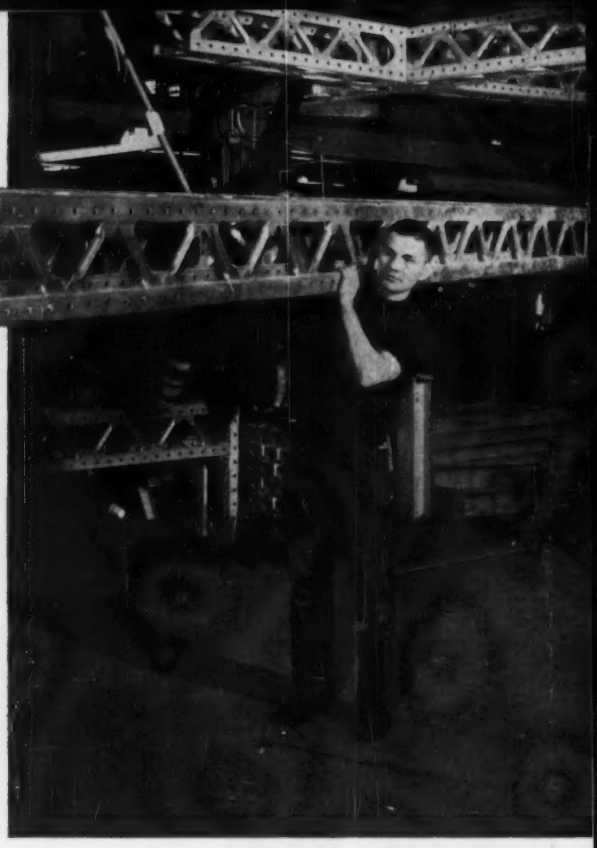
452 R

McGRAW EDISON

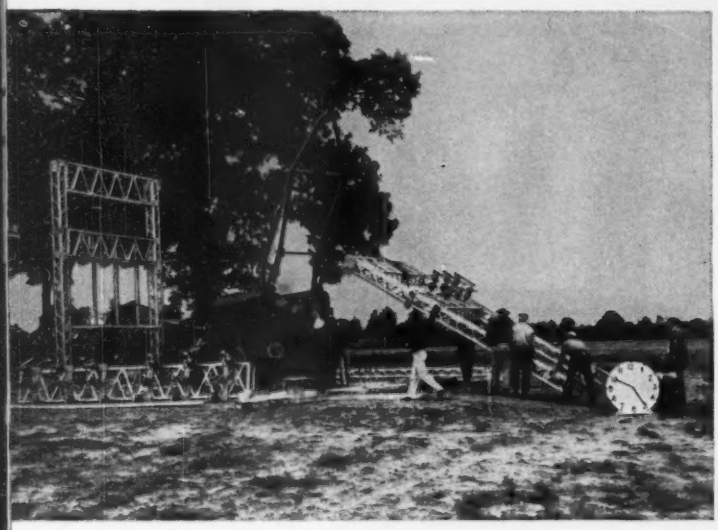
DISTRIBUTION TRANSFORMERS • RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT



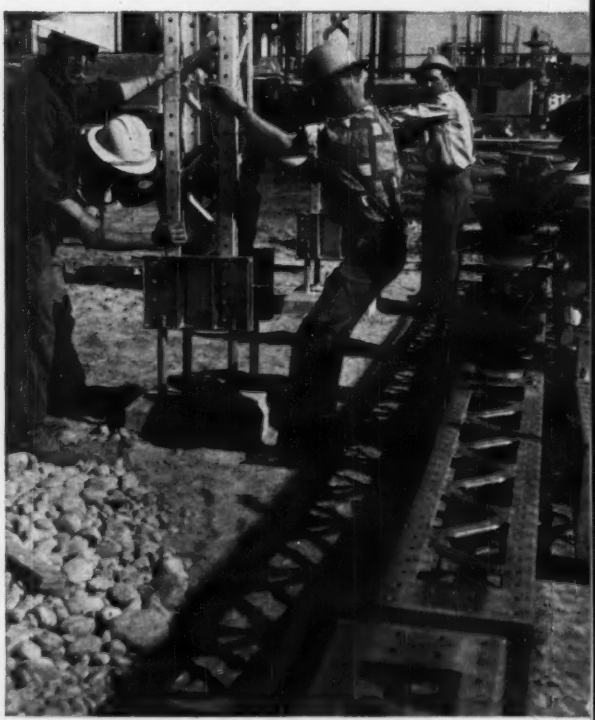
10:15 A.M. Erection of the L-M-Alrectic substation commenced. Linemen use their regular line-truck hydraulic hoist. Columns and trusses were bolted together, and equipment was mounted before the sub-assemblies were erected.

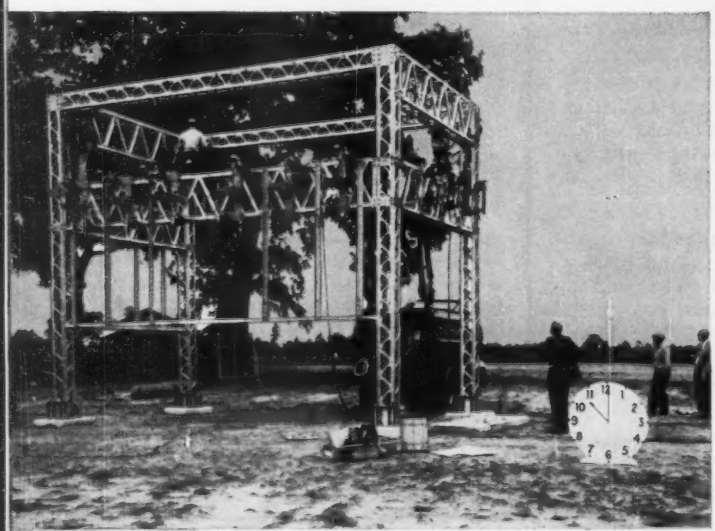


THE SPECIAL DESIGN and construction of L-M-Alrectic substation trusses provide the strength of steel at less than ⅓ the weight. Trusses can be handled on the ground without the aid of mechanical equipment.



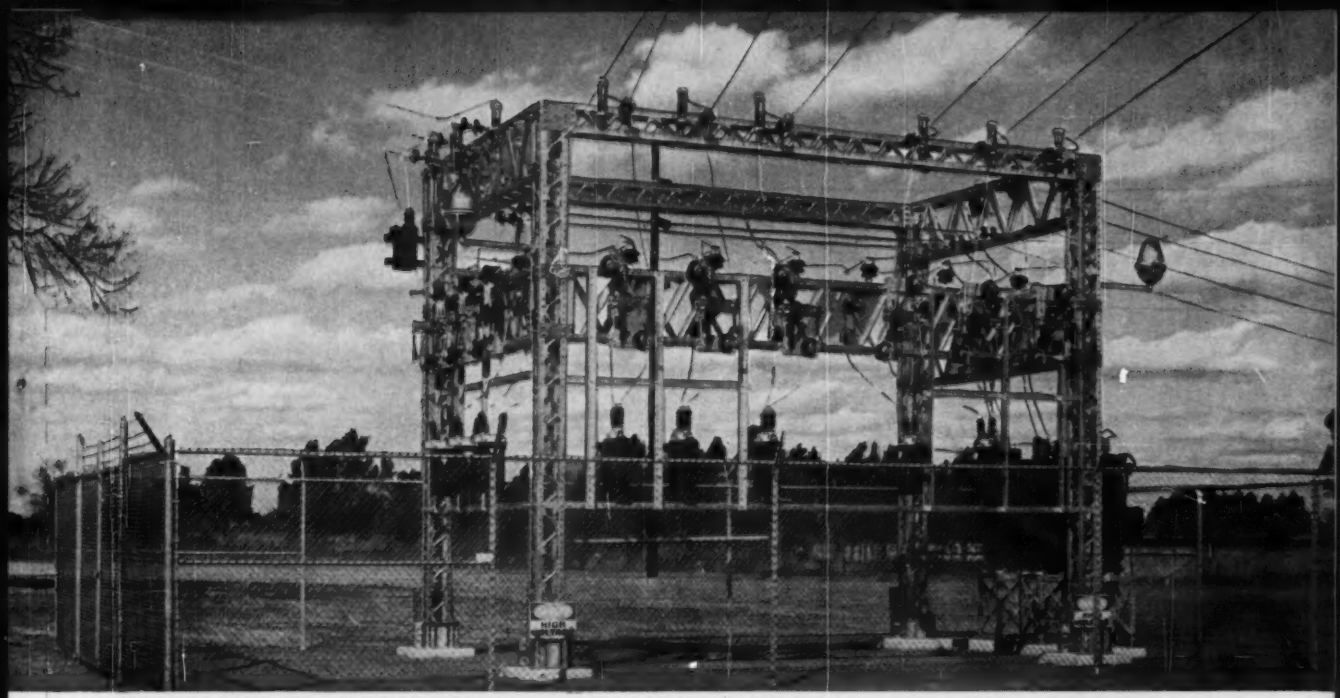
10:25 A.M. In only ten minutes, one column and horizontal truss sub-assembly are already erected. The second is being erected here.





11:03 A.M. Within 48 minutes, the entire Alrectic structure is erected and ready for bus work. Only 18 working hours after material was received the station was ready to be energized.

THE EASE with which this crew guides the base plate over the anchor bolts shows why installation of L-M-Alrectic substations is faster and more economical.



THIS 12 kv REGULATED SWITCHING STATION was erected by a line crew in only 48 minutes. Although this crew had no previous erection experience, the men were still able to install this L-M-Alrectic aluminum substation in an amazingly short time. Columns and horizontal trusses were bolted together and equipment was mounted before the sub-assemblies were erected. Sub-assemblies were then hoisted by means of the regular line-truck hydraulic hoist.

L-M-Alrectic® Aluminum Substations Are Competitive With Steel Structures

Special light-weight design, which facilitates faster installations, makes L-M's aluminum substations competitive with steel substations on an erected basis.

by **W. V. SWAN**
Product Manager
Power Switching • Substations
Line Material Industries

L-M-Alrectic aluminum substations are constructed with standard factory-assembled trusses. Each truss consists of specially designed extruded chord-angles and lacing members that are factory-welded, using fixtures. Because of special design and construction, Alrectic trusses weigh only 30% of comparable steel trusses, but bear equal stresses.

Fast, Economical Installation

Column and horizontal trusses are all pre-assembled when delivered to the job site. They need only to be laid out and bolted together. Alrectic substations are fabricated of aluminum and require no special treatment—no painting, no maintenance. As a result, distortion from galvanizing is eliminated and assembly problems are minimized.

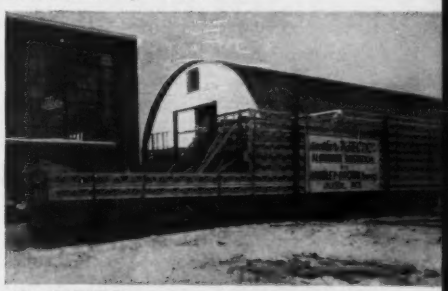
Because of lighter weight, the trusses are easy to handle. Much of the structure can be ground-assembled without a crane. Ground-assembled structures can then be lifted into place with light-duty lifting equipment. Erection of Alrectic substations is easier, faster and, above all, more economical.

Alrectic Competitive with Steel Substations

Special light-weight construction, most economical design, and fast economical installation make it possible for L-M to supply the Alrectic aluminum substation at costs equal to and, in many cases, lower than, steel structures.

Get Complete Information

Be sure you contact your L-M Field Engineer and get all the facts on the Alrectic aluminum substation. The next time you plan a substation, ask your L-M Field Engineer to submit a bid on an aluminum structure. Or write me at Line Material Industries, Milwaukee 1, Wisconsin.



ALL ALRECTIC columns and trusses are fabricated at the factory and are shipped pre-assembled. Light-weight design permits shipping the entire substation on one truck or rail car.

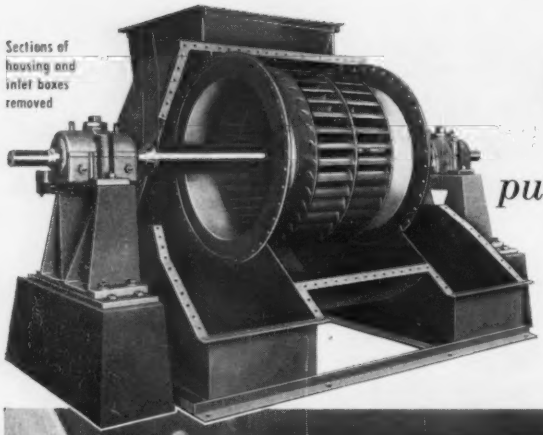
® Registered trademark of Handley-Brown Company

LINE MATERIAL Industries
McGRAW-EDISON COMPANY

439

Substations and Power Switching Equipment

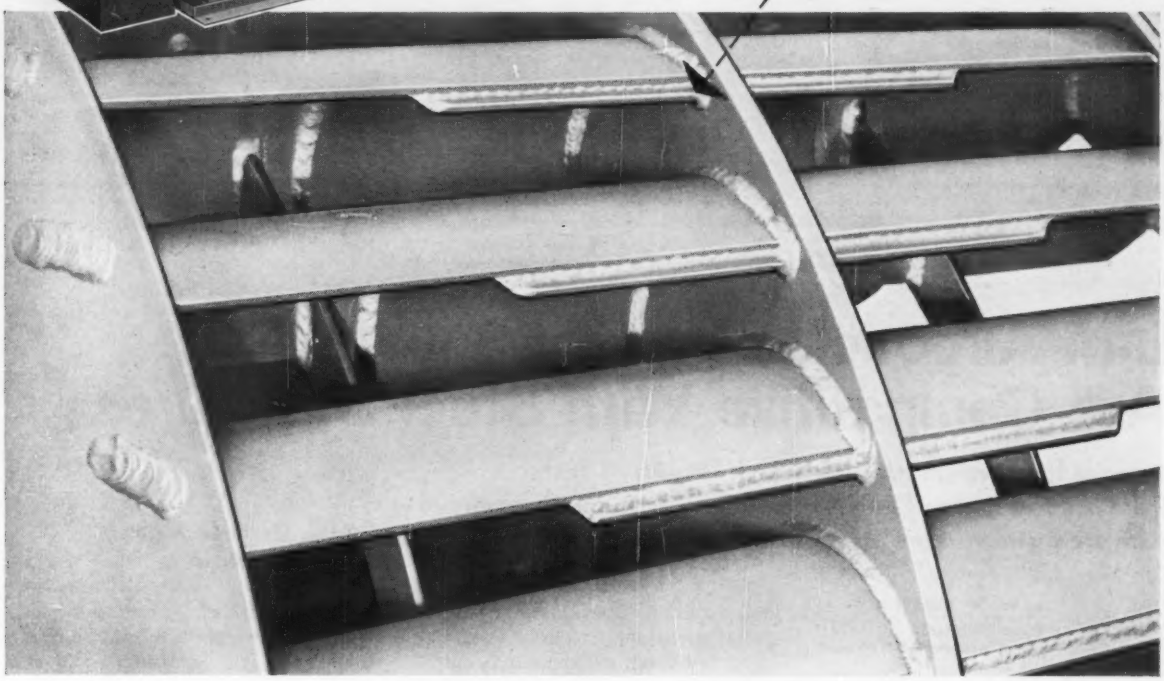
DISTRIBUTION TRANSFORMERS • RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT



CLARAGE

puts wearing plates where they belong

on the face of the blades



DON'T SETTLE FOR LESS! Clarage makes sure you get *extra* service life on those punishing induced draft applications.

The Type DN Dynacurve fan, when equipped with wearing plates, has these abrasion-resisting steel plates welded to the *face* of the wheel blades. A distinguishing Clarage feature that guarantees you less maintenance, longer operation! But that's not all.

You get other advantages, and more, with Clarage Dynacurve fans: Minimum floor space and height requirements. Rugged wheel of 36 radially deep, aerodynamically curved blades and tapered rims. *Bolted* scroll liners for easy replacement. High efficiency over a wide performance range.

For *complete* information, contact our nearest office or write for Catalog 905.

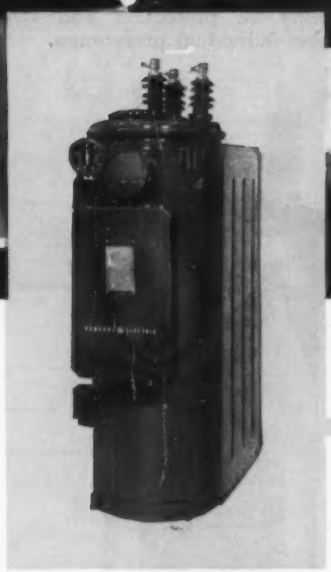
Dependable equipment for making air your servant

CLARAGE FAN COMPANY

Kalamazoo, Michigan

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

ANOTHER STEP AHEAD IN VOLTAGE REGULATION



NEW Permalex Insulation

Permalex* coil insulation in General Electric voltage regulators boosts reliability—lengthens regulator life

New Permalex insulation—another regulator first from General Electric—is now standard on all G-E ML-32 single-phase, step voltage regulators. Permalex makes possible added regulator economies through longer core and coil life and greater reliability—at no price premium.

Permalex insulation preserves high dielectric strength because of the special cyanoethylation of its kraft insulation paper. This process, exclusive with General Electric, retards formation of moisture released by cellulose materials under load—slows aging process of insulation to give you longer regulator life. Permalex insulation is fully compatible with other regulator components and provides a true *system* approach to regulator design.

Another outstanding G-E regulator feature which increases quality, Permalex insulation gives you more regulator for your money. It is, in fact, another reason why *G-E regulators cost less on the line.*

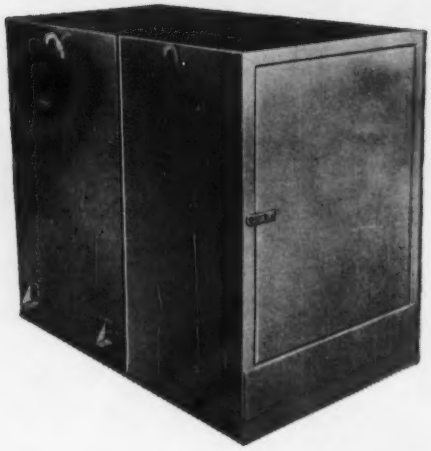
Ask your General Electric regulator representative for more information about Permalex-insulated ML-32 regulators—as well as the entire line of G-E voltage regulators. Or, write to Section 456-03, General Electric Company, Schenectady 5, N. Y.

*Trade-mark of General Electric Company

Progress Is Our Most Important Product

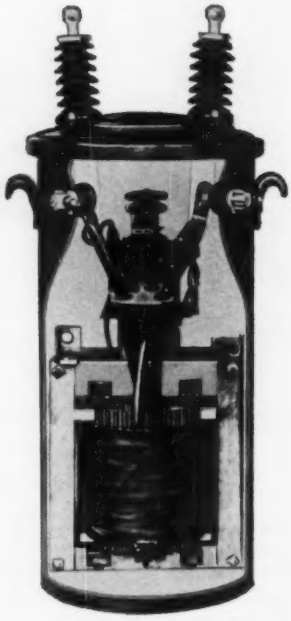
GENERAL ELECTRIC

SELECTING DISTRIBU



STANDARD'S FIELD TESTED, pad-mounted unit's compartmental design permits changes in single phase transformers without a change of terminations. Standard termination compartments give you complete flexibility from 15 KVA through 50 KVA and 75 KVA through 167 KVA. You change the transformer only . . . just as you do on a pole.

You can work on the secondary side with perfect safety because the high voltage side is protected by an inside door. Outside door is equipped with a hasp and lock. Performance data matches that of Standard's SWA series of pole-type units. You have complete flexibility on protection and switching equipment to meet individual preference.



EXCEPTIONAL PERFORMANCE by these SWA units has placed them on the approved lists of leading utility companies. Extremely low copper losses, low impedance and low temperature rise without excessive voltage drop put these units in a class by themselves. Your Standard representative can show you how they reduce "unaccounted for" losses on your system.

TION TRANSFORMERS

AREN'T THESE THE CONSIDERATIONS?

INCREASED VOLTAGE AT THE METER.
INCREASED OVERLOAD CAPACITY.
REDUCED COPPER LOSSES . . . and
SELLING MORE OF PRODUCED ENERGY?

Sure they are! But even more important, you have to ask yourself "What's best for MY system?"

Let's check the chart. A complete set of all ratings are yours for the asking. See how overload can be carried on the SWA without exceeding the 3% voltage drop danger line.

See how the copper loss compares with other transformers when you carry overloads.

Check the thermal time constant as a measure of overload capacity—SWA is 13 to 22% better.

The Standard SWA series of pad-mounted and pole-type distribution transformers hits these problems hard. They slash copper losses a whopping 30% at full load to help you deliver more power to the meter . . . reduce impedance to cut service complaints . . . have low temperature rise without excessive voltage drop.

These dramatic units help you SELL MORE OF THE ENERGY YOU GENERATE OR BUY. Your nearby Standard Transformer Company representative can show you how to apply these units to your system for best results. Check it out today. Get the facts from him. You'll be away ahead where it counts most . . . IN INCREASED REVENUES!

50 KVA — 2400 V. — NO TAPS

CONVENTIONAL 50 KVA WA								STANDARD 50 KVA SWA							
LOAD KVA	CORE LOSS	COPPER LOSS	TOTAL LOSS	% REG. 0.9 PF	%IZ	%IR	%IX	LOAD KVA	CORE LOSS	COPPER LOSS	TOTAL LOSS	% REG. 0.9 PF	%IZ	%IR	%IX
40	"	367	537	1.45	1.68	.92	1.41	40	"	267	437	1.00	1.12	.67	.90
50	"	575	745	1.82	2.1	1.15	1.76	50	"	418	588	1.24	1.4	.83	1.12
60	"	828	998	2.18	2.52	1.38	2.11	60	"	602	772	1.49	1.68	1.01	1.35
70	"	1125	1295	2.54	2.94	1.61	2.46	70	"	820	990	1.74	1.96	1.17	1.57
75	"	1295	1465	2.72	3.16	1.73	2.64	75	"	940	1110	1.86	2.09	1.25	1.68
80	"	1470	1640	2.90	3.37	1.84	2.82	80	"	1070	1240	1.99	2.25	1.34	1.80
90	"	1865	2035	3.26	3.78	2.07	3.16	90	"	1355	1525	2.24	2.52	1.51	2.02
100	"	2300	2470	3.63	4.21	2.3	3.52	100	"	1675	1845	2.48	2.80	1.68	2.24
110	"	2770	2940	4.00	4.63	2.53	3.87	110	"	2020	2190	2.73	3.06	1.84	2.46
120	"	3300	3470	4.35	5.06	2.76	4.22	120	"	2400	2570	2.98	3.35	2.0	2.69

CONCISE FACTS on the complete line of Standard WA and SWA Distribution Transformers are YOURS FOR THE ASKING. Write today for your copy. Check the figures out on your system.

41 years of concentration on transformer design.

Standard Transformer CO.

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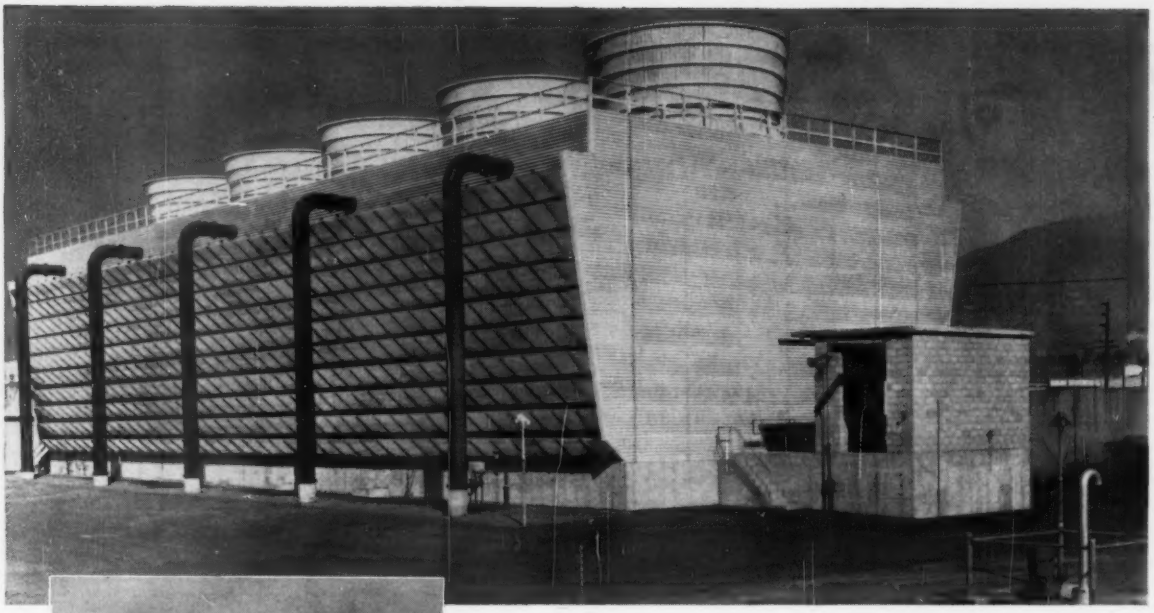
"WHEREVER THERE IS POWER"



WAGNER® MOTORS HELP MARLEY TOWER

At work on the fan deck: Five Wagner Type EP, 75 hp, 480 volts, 1750 RPM Motors.

PRODUCE *MORE POWER* FOR BURBANK

This is the new Marley Class 600 Double-Flow 5-cell cooling tower at the power station of the City of Burbank, California ... the newest thing in cooling tower design. Its job: to cool water to get more kilowatts from steam.

Wherever water cooling is vital to plant capacity, product quality or customer comfort, chances are you'll find a Marley Cooling Tower. You'll probably find Wagner® Motors there, too. They're on this tower in Burbank, driving the huge fans used in the tower's cells.

The job is a rugged one. It calls for motors that can operate without attention month after month ... motors that can stand constant exposure to all kinds of weather and to high humidity, the number one cause of motor failure in cooling tower applications.

Wagner Type EP Motors meet these requirements. All vital parts of these workhorse motors are totally enclosed, and are sealed against moisture by a series of grease retaining grooves between shaft and housing. Running shaft seals, at both ends of the frame, prevent the entrance of water into the bearing housings. The frames, endplates and conduit box are made of heavy cast iron for extra protection against high humidity and corrosion.

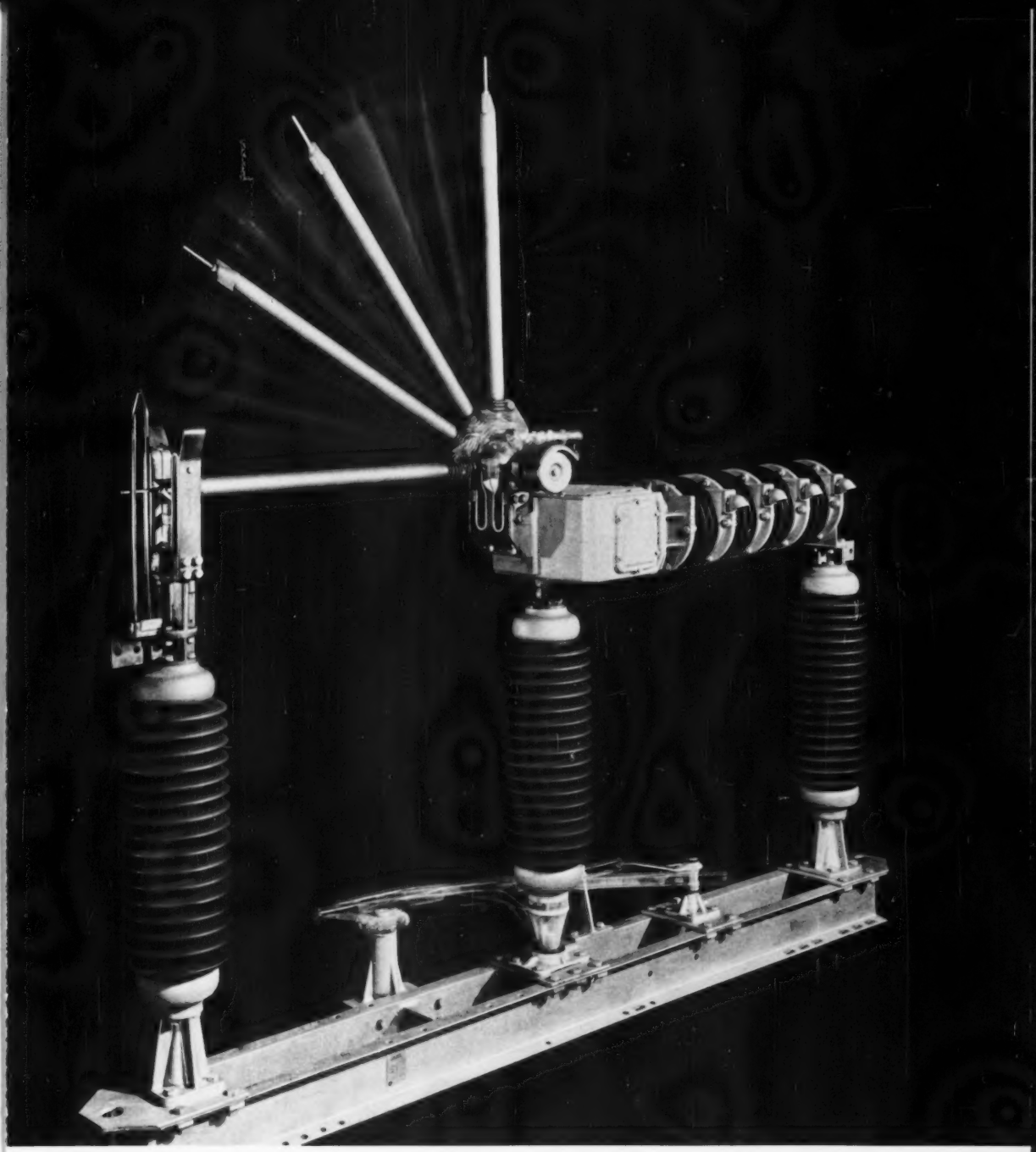
What about your requirements for motor drives that must operate under adverse conditions? Versatile Wagner Totally-Enclosed Motors can meet them, whatever the application. They are available in standard ratings through 500 hp. Call your nearby Wagner Sales Engineer for full details, or write for Bulletins MU-224 and MU-230.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

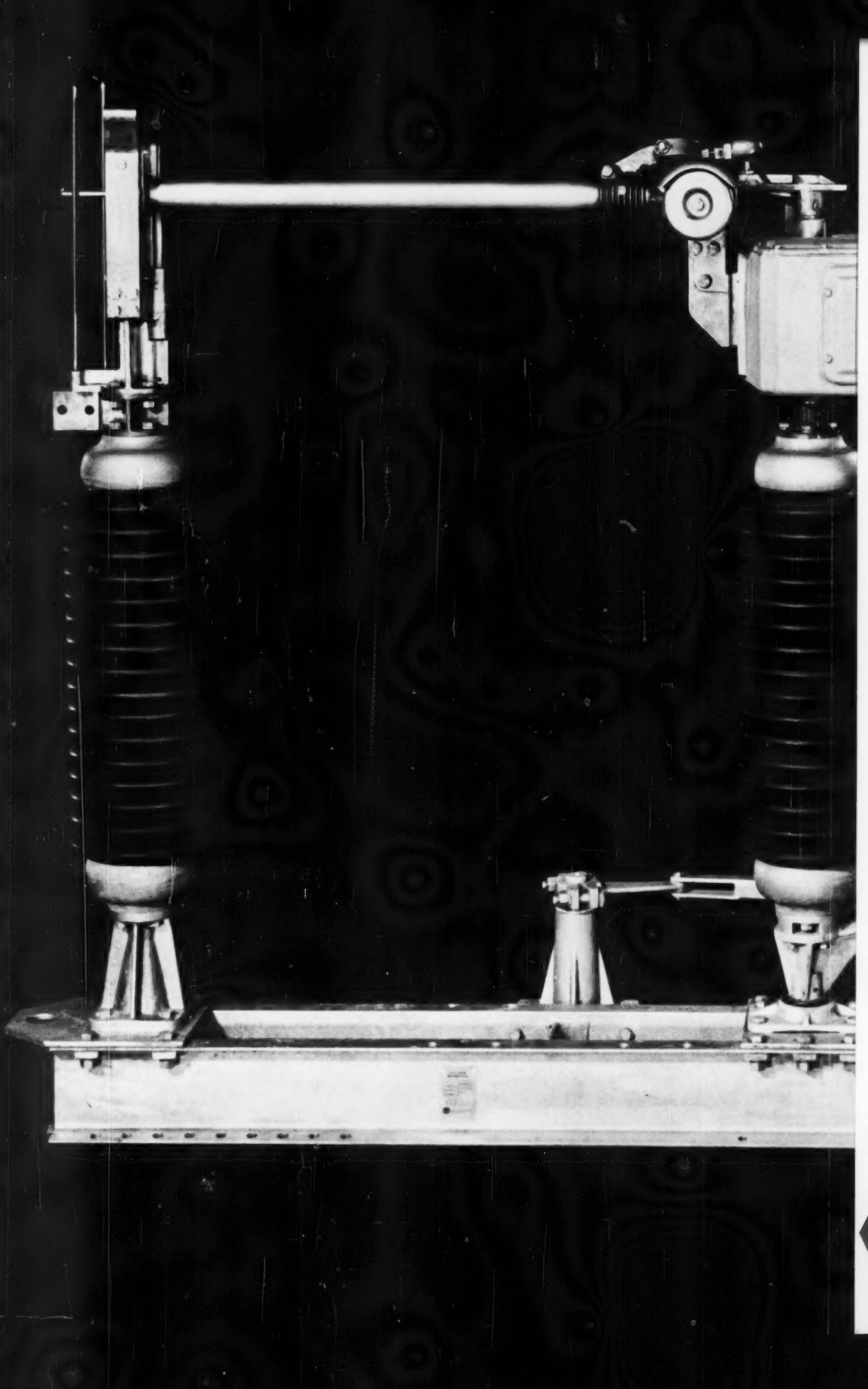
WH60-17



A NEW APPROACH

to switching 34.5 kv to 138 kv circuits . . . a device that combines key functions of both interrupter switches and circuit breakers . . .

Please turn page



S&C announces the

NEW CIRCUIT-SWITCHER

- Hybridizes breakers and load interrupters
- Electrically tailored for specific switching duties
- Mechanically programmed to fit high voltage switching environment
- Operation is "goof-proof"
- Mounts in any position—horizontal, vertical or inverted

Circuit-Switcher is the generic name for a new family of switchgear for handling a number of circuit interrupting duties. It looks like a load interrupter switch but works more like a circuit breaker. It is presently designed for all forms of load switching. Later models will include fault interruption capabilities.

Hybridizes Breakers and Load Interrupters

Circuit-Switcher embodies a new concept in high-voltage circuit interruption. It's a cross between a load interrupter switch and a circuit breaker. From the load interrupter, Circuit-Switcher derives its looks. It mounts like a load interrupter. It is opened and closed like a load interrupter. It isolates circuits visibly with air like a load interrupter.

But like a circuit breaker, S&C's Circuit-Switcher carries current continuously through its interrupting unit. Its vital close-and-trip mechanisms are fully enclosed and protected. Like a breaker, it trips from stored energy, but the energy is stored within the Circuit-Switcher. Also, like a circuit breaker with its trip-free feature and latch-check switch, Circuit-Switcher has built-in positive sequence control.

Electrically Tailored for Specific Switching Duties

Here is the basic problem in high-voltage circuit interruption. The severity of switching duty varies widely with magnitude of the recovery voltage transient following current interruption. And this recovery voltage transient varies widely for the different applications of circuit interrupting devices.

By segmenting switching duty according to severity and by putting the interrupting section of Circuit-Switcher into modular form, S&C introduces the idea of tailoring circuit interrupting devices to fit specific applications within a given voltage class. A Circuit-Switcher can be selected that has just the number of interrupting units actually required. No more switching capability has to be bought than is needed. Recovery voltage withstandability can be matched to the recovery voltage characteristics of the specific applications through building up the proper number of modular units in series.

Mechanically Programmed to Fit High Voltage Switching Environment

Heart of the Circuit-Switcher is an interrupting unit capable of carrying current continuously and withstanding short-time surges, combined with a "brain" mechanism with built-in sequence control. Thus it differs from a load interrupter switch where the disconnect is dominant and the interrupting unit is an accessory.

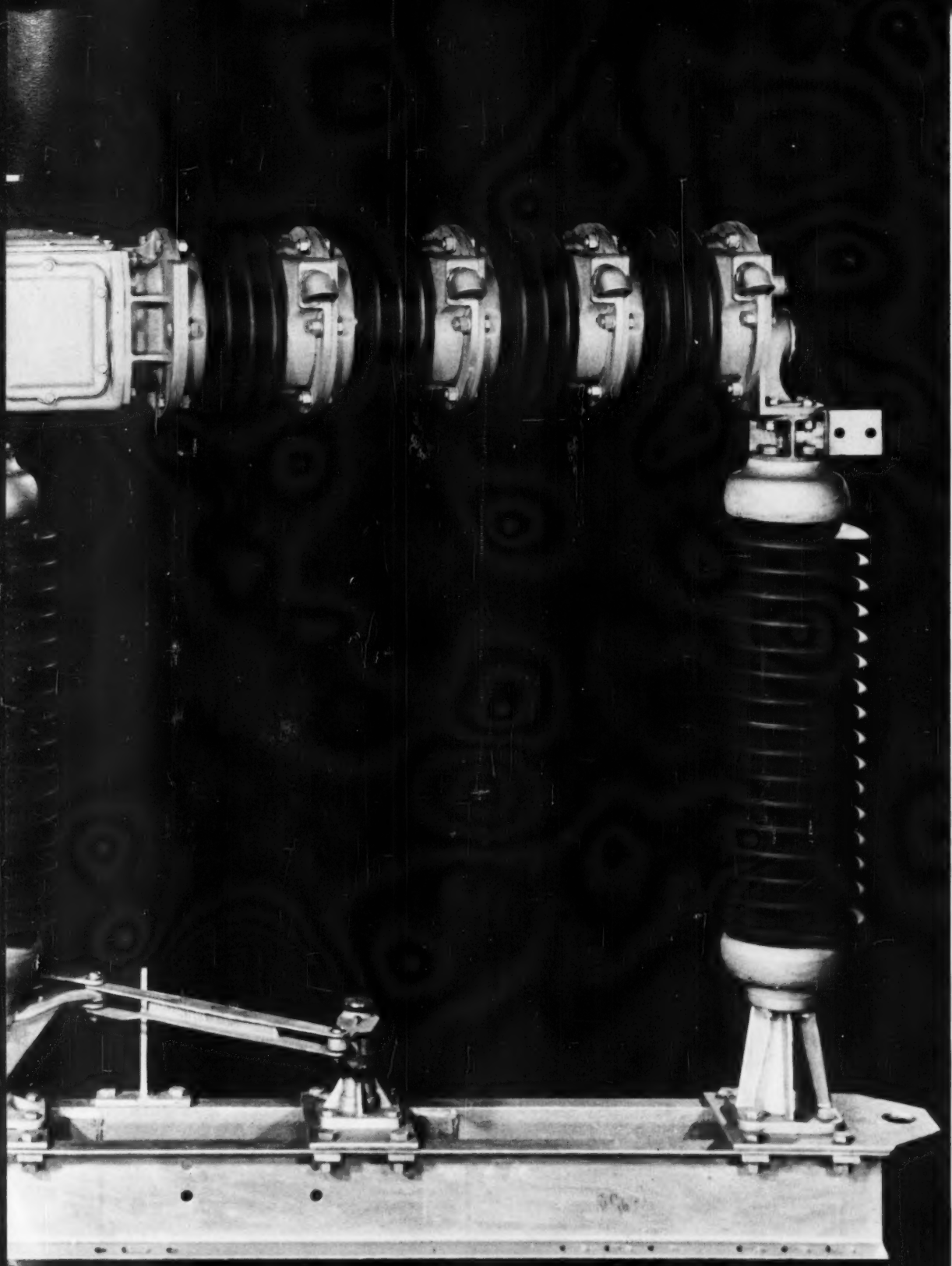
This approach meets critical requirements at higher system voltages; including problems of optimum performance under icing, effective closing action on faults and inrush currents, and high-speed interrupting action independent of operator speed.

Operation is "Goof-Proof"

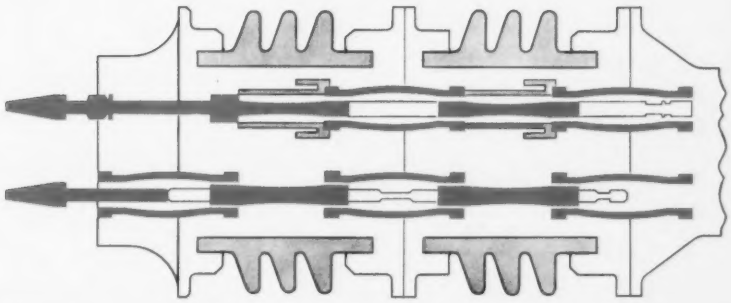
The correlation of interrupting section action, disconnect blade action, and operating handle action is pre-scheduled by the "brain" mechanism. Any operating procedure—such as reversing direction in "mid-stream"—will not result in improper sequencing of interrupting section and disconnect blade.

If you would like to know more about Circuit-Switcher and the wide range of switching duties it can handle, please contact S&C Electric Company, 4435 Ravenswood Ave., Chicago 40, Illinois.

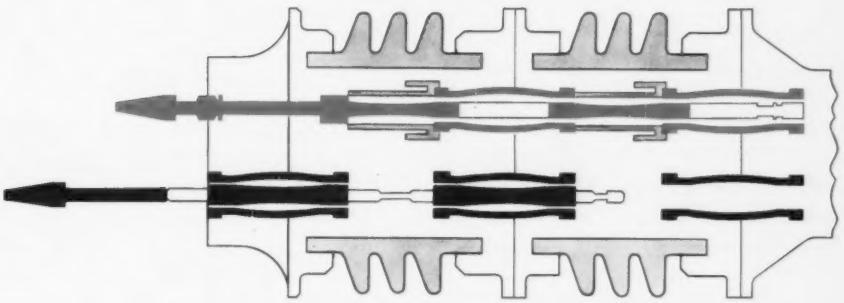
S&C ELECTRIC COMPANY



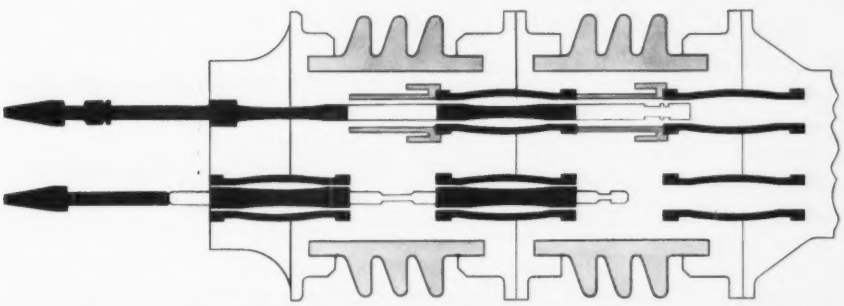
HOW THE CIRCUIT-SWITCHER'S INTERRUPTING SECTION WORKS



Two, not one, movable current-carrying rods are the distinguishing feature of the S&C Circuit-Switcher. A heavy-duty rod (lower of the two shown) is the continuous current carrying member. The upper rod is a light-duty current interrupting rod. The red lines show both rods carrying full load current simultaneously.



When the disconnect blade starts to open the continuous current carrying rod moves rapidly forward to the disconnect position. It is powered by independent stored energy. This heavy-duty rod as shown here is now out of the circuit and the light-duty interrupting rod is momentarily carrying all of the current. . . .



But the interrupting rod now shoots forward at high speed to cleanly break the circuit inside the arc extinguishing chambers. Now the current is completely interrupted. As the disconnect blade moves to full open position both rods move back to closed position (as shown in the top figure). The disconnect blade is now isolating the circuit. It is impossible to close the disconnect blade when the two rods are in the open position. And if the blade is closed to within striking distance of the jaw, but then reversed toward the open position, the rods trip . . . no external arcing occurs.

One pole of a three pole vertical break, 69 kv Circuit-Switcher. This unit has four interrupting units.

S&C HAS SEGMENTED 66 APPLICATION VARIABLES AND BUILT A CIRCUIT-SWITCHER TO FIT EACH

Eight major application classifications have been established . . . including such duties as transformer switching, load dropping, load splitting, line dropping, cable switching, and capacitor bank switching. The major classifications are further subdivided by type of circuit connection and system grounding. You can match the proper Circuit-Switcher to each application.

For These Applications

Application			Maximum Amperes Interrupting	Symbol		
Class		Qualifications		Solidly Grounded System	Effectively Grounded System *	Ungrounded System
Transformer Switching	Parallel Switching§	Max 60 cycle recovery voltage: 20 kv rms	600	A	A	A
		Max 60 cycle recovery voltage: 40 kv rms	600	B	B	B
		Max 60 cycle recovery voltage: 60 kv rms	600	C	C	C
		Max 60 cycle recovery voltage: 80 kv rms	600	D	D	D
	Load Dropping	Transformer primary wye-connected with solidly grounded neutral	600	E	F	G
		Transformer primary wye-connected with effectively grounded neutral *	600	F	F	G
		Ungrounded transformer	600	G	G	G
	Magnetizing Current Switching	Transformer primary wye-connected with solidly grounded neutral	●	E	F	G
		Transformer primary wye-connected with effectively grounded neutral *	●	F	F	G
		Ungrounded transformer	●	G	G	G
Line Switching	Load Splitting (Parallel or Loop Switching)	Max 60 cycle recovery voltage: 20 kv rms	600	A	A	A
		Max 60 cycle recovery voltage: 40 kv rms	600	B	B	B
		Max 60 cycle recovery voltage: 60 kv rms	600	C	C	C
		Max 60 cycle recovery voltage: 80 kv rms	600	D	D	D
	Load Dropping★	Load-side neutral solidly grounded	600	E	F	G
		Load-side neutral effectively grounded *	600	F	F	G
		Load ungrounded	600	G	G	G
	Line ★ Dropping▲		†	K	K	L
Cable Switching		Shielded Cable	200	H	H	K
		Unshielded Cable	200	K	K	L
Capacitor Bank Switching		Grounded Capacitor Bank	‡	H	H	L
		Ungrounded Capacitor Bank	‡	L	L	L

* X_0/X_1 from 0 to +3.0 and R_0/X_1 from 0 to +1.0

§ Switching primary of transformer which remains energized from secondary bus

● Circuit-Switcher will switch magnetizing currents associated with loads up through 600 amperes

★ These application classifications are based on recovery voltage considerations judged to apply to typical system and switching conditions. In special applications involving lightly loaded lines, resonant conditions may be encountered. For recommendations for such applications refer to S&C.

▲ Based upon circuit interruption being performed solely within the interrupting units, with no external arcing. (All other applications shown are also based on this performance criterion.)

† Maximum length of line: 100 miles

‡ Refer to S&C

Use These Circuit-Switchers

Style	Rating			Number of Inter. Units per Pole	Applications (See Table above)
	Kv		Amperes Cont.		
	Nominal	Max Des.			
Three Pole Vertical Break	34.5	38	600	1 2 4	A E B E F G H K D E F G H K L
	46	48.3	600	1 2 3	A B E F G C E F G H K
	69	72.5	600	1 2 3 4	A B E C E F G D E F G H K
	115	121	600	1 2 3 4	A B C E D E F
	138	145	600	1 2 3 4	A B C D E

S&C Electric Company
Chicago 40, Illinois

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for modern construction are now possible with RT&E's Terra-Tran for underground distribution. Terra-Tran provides improved appearance for residential areas, more reliability for industrial plants, greater safety for institutions, and freedom from primary wires and poles for shopping centers. Terra-Tran is truly the long-sought key to economical underground distribution.

RT&E CORPORATION
WAUKESHA, WISCONSIN
PORTLAND, OREGON

HH

WHICH JOB WOULD YOU TAKE?

If you're like most of us, you'd take the job with the more tempting salary and the brighter future.

Many college teachers are faced with this kind of decision year after year. In fact, many of them are virtually bombarded with tempting offers from business and industry. And each year many of them, dedicated but discouraged, leave the campus for jobs that pay fair, competitive salaries.

Can you blame them?

These men are not opportunists. Most of them would do anything in their power to continue to teach. But with families to feed and clothe and educate, they just can't make a go of it. They are virtually *forced* into better paying fields.

In the face of this growing teacher shortage, college applications are expected to *double* within ten years.

At the rate we are going, we will soon have a very real crisis on our hands.

We *must* reverse this disastrous trend. You can help. Support the college of your choice today. Help it to expand its facilities and to pay teachers the salaries they deserve. Our whole future as a nation may depend on it.

It's important for you to know more about what the impending college crisis means to you. Write for a free booklet to: HIGHER EDUCATION, Box 36, Times Square Station, New York 36, N.Y.

ADVERTISING COUNCIL PUBLIC SERVICE

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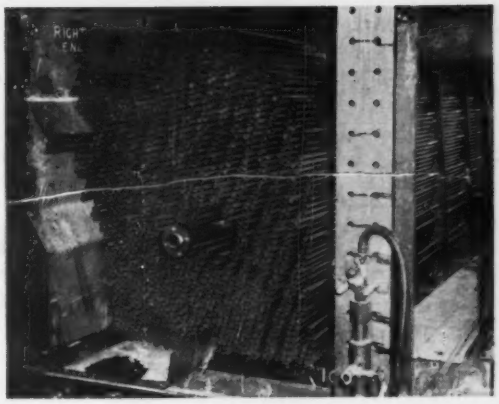
HIGHER EDUCATION
KEEP IT BRIGHT

New Dickerson Station of Pepco equipped with over 170 miles of Phelps Dodge Condenser Tubes!



The newest power station of the Potomac Electric Power Company at Dickerson, Md., fills a big need for increased electric power in the greater Washington, D.C., area. The plant's two mammoth generating units, each with a capacity of 175,000 kilowatts, boost PEPCO's total electrical capacity by nearly one-third.

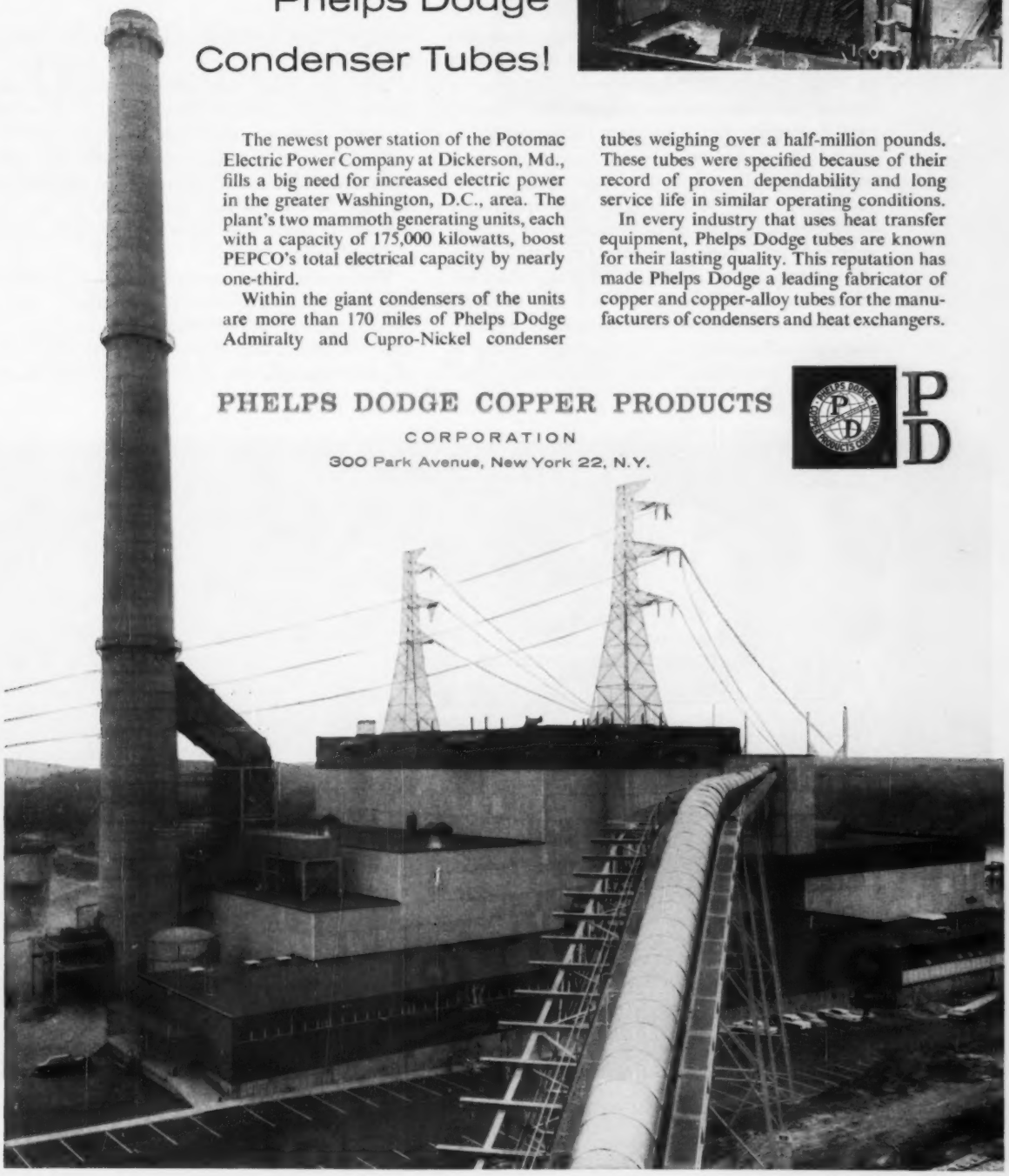
Within the giant condensers of the units are more than 170 miles of Phelps Dodge Admiralty and Cupro-Nickel condenser tubes weighing over a half-million pounds. These tubes were specified because of their record of proven dependability and long service life in similar operating conditions.

In every industry that uses heat transfer equipment, Phelps Dodge tubes are known for their lasting quality. This reputation has made Phelps Dodge a leading fabricator of copper and copper-alloy tubes for the manufacturers of condensers and heat exchangers.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 Park Avenue, New York 22, N.Y.

PD

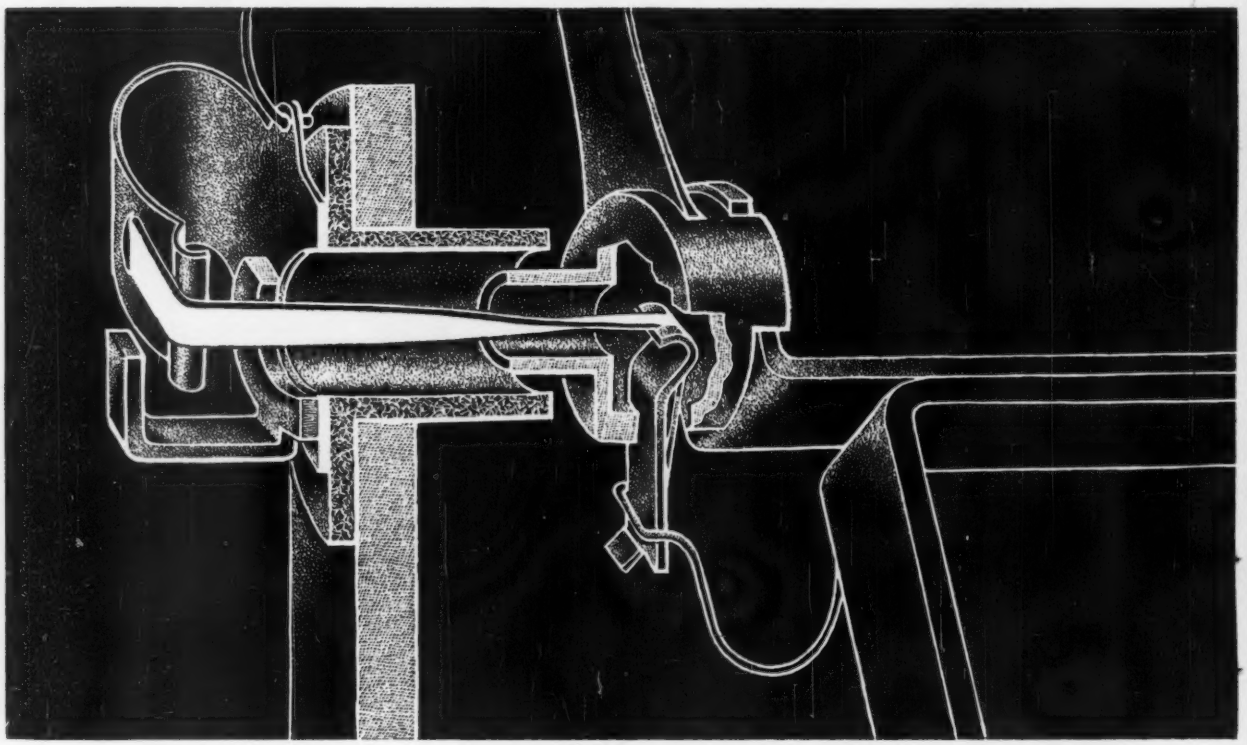


Westinghouse extends "TAUT BAND SUSPENSION" to full line of

As a result of the outstanding performance records and customer preference established by thousands of Westinghouse TBS* instruments in all types of applications during the past year, this revolutionary new instrument design has now been extended to the full line of our switchboard instruments. These include the full-view 4½" circular scale, and 6" rectangular 100° scale designs. This remarkable development, introduced by Westinghouse in 1958, enables Westinghouse instruments to withstand extreme vibration and shock that adversely affect any other instrument. Users have found, too, that TBS offers *complete freedom from replacement of pivots, bearings and springs* . . . a significant saving in instrument maintenance costs. All types also meet or exceed ASA Specification C39.1 for switchboard instruments.

Exhaustive tests, conducted over a period of more than three years, included the most severe shock and vibration conditions that could be imagined for instruments. Field performance has more than justified our expectations. Application data derived during this period will help us continue to lead the industry in developing more accurate and reliable instrumentation for you.

Elimination of the conventional pivots and bearings provides an extremely rugged unit . . . eliminates friction . . . provides higher sensitivity . . . and results in almost infallible repeatability. For example, the Type KX-241, 250° full-view instruments



switchboard instruments

have full-scale deflection as low as 50 microamperes. Even higher sensitivities are available in the Type KX-251, 100° scale designs. These sensitive instruments will continuously withstand overloads up to 150 times full-scale deflection.

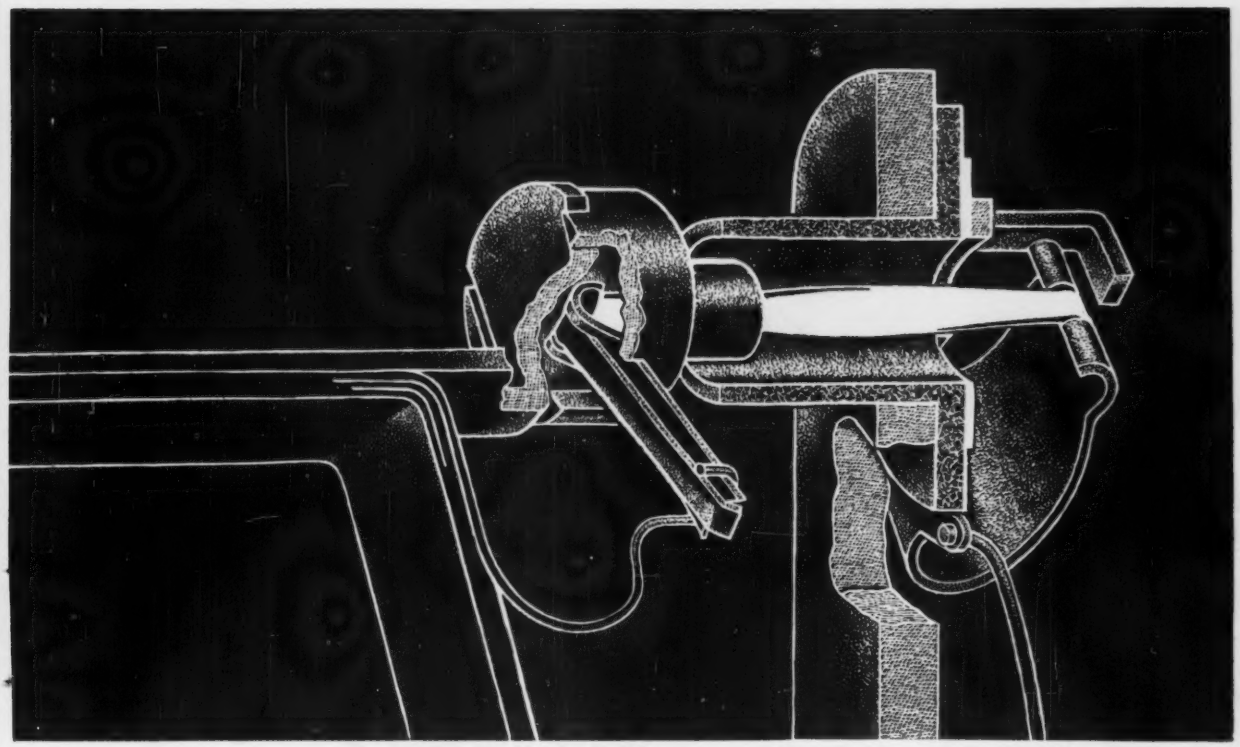
The Westinghouse TBS switchboard instrument line includes: both a-c and d-c ammeters, milliammeters, voltmeters; d-c microammeters; frequency meters; temperature indicators and ground detectors; a-c wattmeters and varmeters with Hall generator watt transducers.

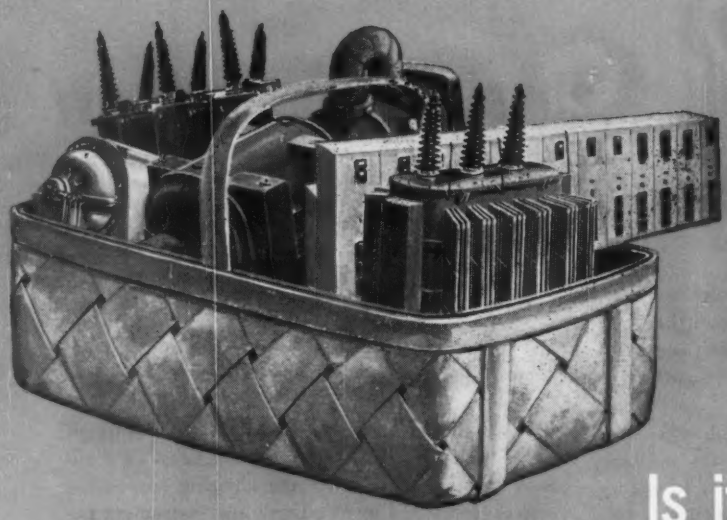
Call your Westinghouse representative for complete details of the remarkably rugged TBS line. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

*Westinghouse "Taut Band Suspension"—A tough metal band about one-tenth the thickness of a human hair is the heart of the amazing suspension system developed by Westinghouse instrument engineers. All Westinghouse instruments shipped after June 30, 1960, using Taut Band Suspension will bear the trade-mark *tbs* on the dial face. J-40532

YOU CAN BE SURE...IF IT'S Westinghouse

TUNE IN WESTINGHOUSE CBS TV-RADIO COVERAGE, PRESIDENTIAL CONVENTIONS, JULY 10-29





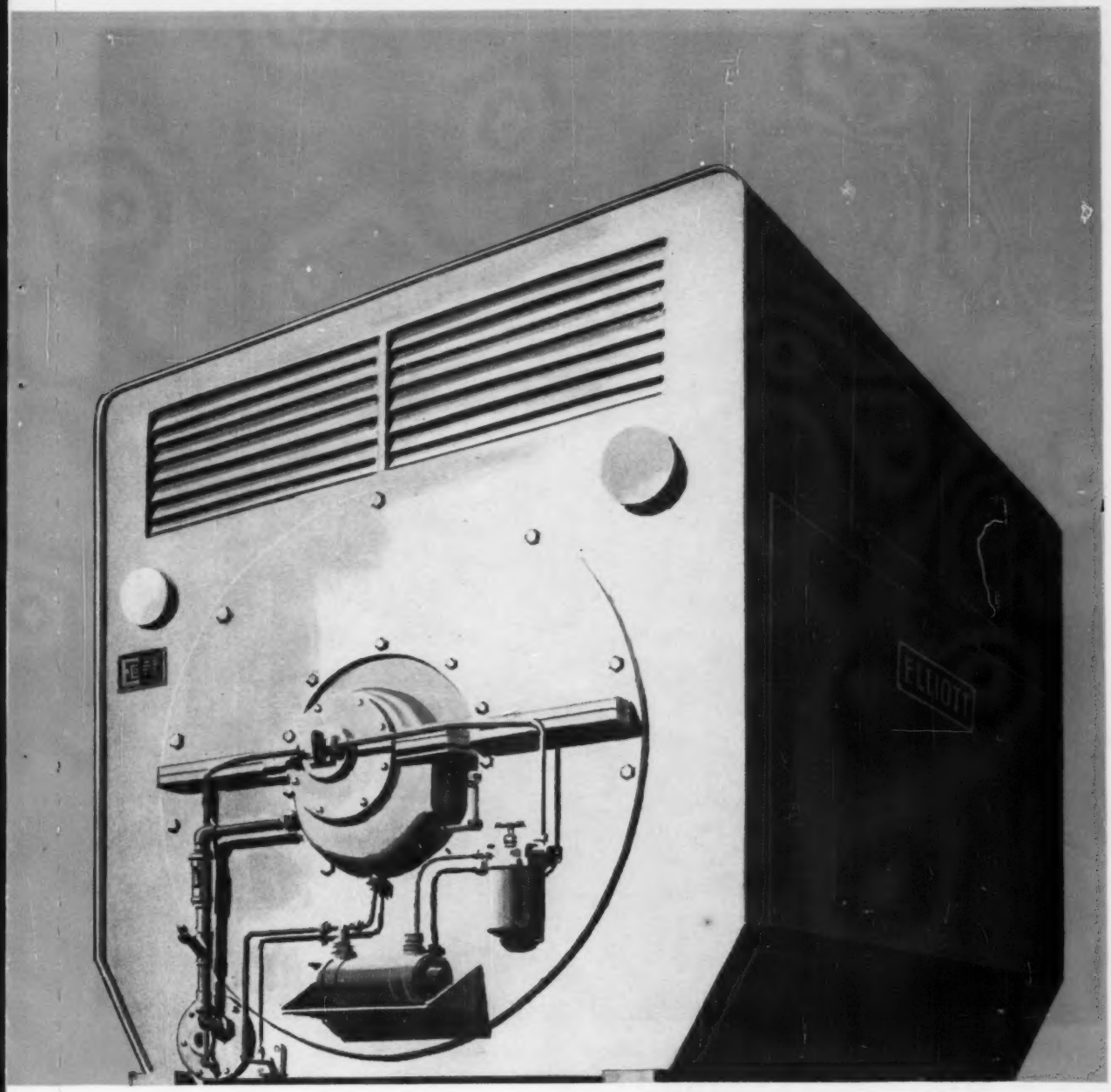
Is it wise to risk "MARKET-BASKET" buying when selecting boiler-feed pump motors?

YOUR MOST IMPORTANT AUXILIARY SHOULD BE THE BEST YOU CAN BUY

Just any large motor won't do. Since the boiler-feed pump motor is your most important auxiliary, it should be the very best you can find. That's why it pays to ask yourself . . . does "unified responsibility" (or market-basket buying) really assure me of the best units? . . . will this plan give me the *best* large motor I can buy? . . . is this the way to get the best engineered drive? . . . *am I really getting a bargain* if my most important auxiliary gives me less than the best in long life and uninterrupted performance?

Elliott leadership in large powerhouse motors is based upon its fabulous record of repeatedly building the largest and best 2-pole motors in the industry . . . its introduction of the first super-quiet motor in the 5000-hp size . . . its engineered functional "Fabri-Steel" frame design . . . its many types of enclosures . . . its ease of access to bearings and internal parts . . . and its outstanding 8-year "Fabri-Seal" insulation field service record without a single failure. For complete details, write Elliott Company, Ridgway Plant, Ridgway, Pa.

ELLIOTT Company



Ask your engineers and operating men... **"Who builds the BEST POWERHOUSE MOTORS?"**

The men in your company who are most thoroughly familiar with boiler-feed pump motors know how to recognize the design and construction features that contribute to long life and dependable trouble-free operation. Ask them if they recommend buying by the "market-basket" system . . . or from a specialist. Ask them "Who builds the *best* powerhouse motors?"

SPECIALISTS for 50 years

Elliott built the world's first large 2-pole motor in 1916. And over the years since then Elliott has specialized in large squirrel-cage induction motors which have established outstanding operating records.

PACEMAKERS in advanced designs

Elliott has consistently pioneered in new and advanced large motor designs—all "firsts" in the industry. And today, Elliott has either built or is building 46 of the largest two-pole motors ever built . . . 18 motors, each 4500 hp . . . 24 motors, each 5000 hp . . . 4 motors, each 6000 hp.

RB-2A

Photo by Riehle Studios

Minnesota's Capital City

St. Paul, capital city of Minnesota, is prominent, too, for its widely diversified industries. These include brewing, food processing livestock marketing, manufacturing, oil refining and printing. The city's transportation needs are served by nine different railroads, totalling one quarter of the nation's rail mileage.

The combination of demands for electric power is expected to nearly quadruple power needs of the area within 20 years. This requirement, together with the future needs of railroads and all industry, is being anticipated by Kerite, with a standard of cable dependability established in 1854. *As the need for quality cable continues to grow, Kerite will be ready to supply it.*

KERITE CABLE

it's the **KERITE** *that makes the difference*

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Editorial Comment

JUNE 27, 1960

Fermi Case Can Clear Loose Legal Ends

In finding that the Atomic Energy Commission should not issue a construction permit without first determining that a proposed nuclear plant will be safe to operate, the Circuit Court of Appeals (EW, June 20, p 82) has put those utilities now building reactors in an uncomfortable position. But perhaps it is best that the law be clarified at this still early stage in the development of civilian nuclear power.

The Enrico Fermi case shows that the Atomic Energy Act has some significant loose ends. From the findings, at least these questions have arisen and stand unsatisfactorily answered:

- Do the still rapidly moving developments in nuclear power justify the Commission's policy of deferring final safety decisions to the hearings on operating licenses?
- Does the proximity of plant location to a *large* population center demand greater safety than to less populated areas, or do we weigh the value of human life per se?
- Does the Fermi station, because of location or design, fail "to protect the health and safety of the public" in violation of the Atomic Energy Act?

We don't know the answers. But if an appeals court is questioning the AEC's interpretation of its enabling act, we feel that the matter should be cleared up at once. The reactor safety question has been with us for a long time, and atomics still scares some of the public.

There must some day be public acceptance of these plants. And a step toward this is the clarification of AEC procedure in this area.

Now We Take Off the Kid Gloves and Sell

The Live Better Electrically program is taking a big step forward in deciding to sell the competitive advantages of electricity over gas.

Acceptance of this basic policy will enable LBE to bring its national advertising program into much sharper focus.

It will serve as an inspiration to the commercial departments which have felt compelled to tread lightly toward our competitive advantages.

And, we believe, it will help electric utilities sell more kwhr.

The decision to strengthen LBE policy is based on opinion surveys of utility executives, trade allies, and customers. Certainly as far as the executives were concerned, the national gas promotion was considered stronger and more effective than LBE. Part of this advantage was gained by higher advertising expenditures on the part of our competitors, but part of it was likely due to the sharper messages in gas advertising.

Seldom have the gas fellows shied away from selling whatever competitive advantages they thought they had over electricity. Their messages have fully recognized the competition and have aimed at combatting it.

Customers have pretty well accepted the *necessity* of cooking and heating. What we have to sell them is the *advantage* of electric cooking and electric heating.

Comic Opera Twist to Utility Sale

"It looks like something from Gilbert and Sullivan," a Mexican banker commented on a recent wrinkle in the Mexican Light & Power Co sale of Sofina stock and ownership to a mysterious "undisclosed" client.

Now the trail leads in comic opera fashion to Liechtenstein, that famous miniscule kingdom somewhere in Europe. It has been announced via page ads in Mexico City papers by First National City Bank of New York that Sofina, a Belgian holding company sold its shares via circuitous route to the "Central American Investment Trust of Liechtenstein." Offers from this newly formed holding company are being advertised to buy all Mexlight stock at the juicy $20-per-share price. National City was given the order for the announcement from Hambros Bank in England who in turn got its order from the Hong Kong—Shanghai Bank in Paris which said it is acting on behalf of its client in Liechtenstein. Nobody officially knows who this new Liechtenstein agent is.

National City is just one of four banks authorized to pay for Mexlight shares—others are Hambros, Credit Bank, Brussels, and Canadian Bank of Commerce, Toronto.

Two strong possibilities as to who the buyer really is—both have Mexican government ending up as owner. First possibility—Mexican government is touchy after its outright purchase of American & Foreign Power utility, and feels it must use devious methods to obtain Mexlight control and then possibly offering big chunks of remaining shares to Mexican private interests or public. Mexican bankers convention lashed at government for becoming "socialistic" after American & Foreign Power purchase.

Second possibility—strong Mexican private group buying shares, possibly with some foreign financing, to get company and eventually sell to the government at a profit. One case of this type operation was seen in a group headed by former President Miguel Aleman and Mexican tycoon Carlos Trouyet, which bought out Chihuahua Railroad and forest lands for around $10 million. Soon after they sold to the government which was nationalizing all railroads. This kind of deal needs inside government contacts. These are just weighted speculations, but coming from top Mexican and foreign banking executives.

As an interesting side note, announcement was made that Chase Manhattan, Chemical Corn, First National City, Swiss Credit Bank and Sofina are coming through with a $13 million dollar loan to Mexlight. This was denied by Chase and other banking officials who claim loan was under study but now being held in abeyance awaiting outcome of the comic opera.

House Group Approves Advertising Deductions

Legislation to permit federal income tax deductions for certain lobbying activities—including political advertising—has been approved by the House Ways & Means Committee.

The bill, introduced by Rep Hale Boggs (D-La.), has a chance of passage in the House, but Congress is almost certain to adjourn before the Senate has a chance to act on the measure.

After the bill was approved by the House group, its language was amended and revised. The changes, however, do not change the substance of the bill.

The bill was introduced early this year, after the Internal Revenue Service had ruled against income tax deductions for lobbying ads and other expenditures—including contributions to labor unions and trade organizations where even a minor part of the dues were spent for lobbying. Labor, management and the IRS teamed together in an unusual alliance to push for revision of Section 1962 of the Internal Revenue Code of 1954—on which IRS based its ruling in late 1959.

In the June 13 issue of Electrical World we inadvertently made an incorrect listing of officers of High Temperature Reactor Development Associates. To eliminate the resulting confusion, here is a correct list.

President, R. E. Ginna, chairman, Rochester Gas & Electric Corp; **Executive Vice President,** L. R. Gaty, vice president, Philadelphia Electric Co; **Vice President,** Kinsey Robinson, chairman, Washington Water Power Co; **Vice President,** J. F. Davenport, executive vice president, Southern California Edison Co; **Secretary-Treasurer,** F. E. Drake, Jr, assistant vice president, Rochester G&E.

More Firms Indicted On Price Fixing Charge

The Justice Department has handed down another indictment charging manufacturers with fixing prices. The Philadelphia Grand Jury also amended an earlier indictment to drop charges against two individuals and name another.

Named in charges of fixing prices in the sale and distribution of industrial control equipment are: General Electric Co, Westinghouse Electric Corp, Allen-Bradley Co, Clark Controller Co, Cutler-Hammer Inc, and Square D Co. Also named are five individuals with the companies.

Three firms named as co-conspirators, but not as defendants, are: Allis-Chalmers Mfg Co, Arrow-Hart & Hegeman Electric Co, and Ward Leonard Electric Co.

In amending a power switchgear assemblies indictment, the names of Clarence E. Burke and G. R. Fink of GE were withdrawn and A. F. Vinson was added. Vinson is vp-group executive for apparatus and industrial products of GE.

Upper Colorado Interest Rate May Be Lowered

Proposed federal Curecanti Reclamation project on the Gunnison River, Colo.—as well as future, smaller, participating projects in the Bureau of Reclamation's Colorado River Storage Project—would win lower interest payments on the money borrowed from the US Treasury.

That's the purpose of language in a bill now awating President Eisenhower's signature. Actually, the language is in a rider on another bill (S-2892) to authorize construction of an unrelated small water supply project, the Norman project, Okla.

The President will have 10 days to consider the measure after it is presented to him on his return from the Far East. What he will do can be predicted logically in two ways:

(1) He will sign it because the Eisenhower Administration is on record in favor of the type of interest formula it contains—in the 1958 Water Supply Act;

(2) He won't sign it because it will reduce interest payments at Curecanti from 4.125% to 2.625%, and this will cost the US Treasury a considerable amount of money. Also, the Colorado River Storage Act was signed into law on the basis of an interest formula different from the 1958 act.

Actually, the President's veto of S-2892 would have no effect on the Norman project. That project is included also in the Omnibus Rivers and Harbors Flood Control Act now moving through Congress.

Advocates of the Upper Colorado interest change point out that it simply brings the two formulas into line. And they add that this differential has become more pronounced in the last three years during a period of high interest rates.

Under the proposed new formula (also in the 1958 Water Supply Act), the rate of interest would be based on the average of all outstanding federal long-term borrowings, maturing in 15 years or longer. Under the existing Upper Colorado formula, interest is based on the cost of federal long-term borrowings during the month of June following the start of work on any specific project.

The proposed change in interest rates would not apply at Glen Canyon or Flaming Gorge Dams, already under construction. But the House Interior Committee points out that the interest rate on these two dams, under the existing formula, would be "quite closely consistent" with the rate proposed for Curecanti under the new formula. Glen Canyon and Flaming Gorge were started during a time of lower interest rates.

Lower interest payments, of course, would have an effect on water and power rates paid by users in the Colorado project area. Curecanti would consist of two dams: Blue Mesa and Morrow Point. A third dam, Crystal, is still under consideration. The two dams would cost $72.5-million, generate 100,000 kw of power, impound 1,030,000 acre-ft of water. In addition, Curecanti would be assigned $10-million of the Upper Colorado project's transmission line costs.

Curecanti has been authorized for several years, but first-year construction money is included in the 1961 Public Works Appropriation Bill, now pending in Congress.

Court Denies Damages For Water Right Loss

The US Supreme Court says the federal government is not liable to the State of Oklahoma for water power rights the state claims it lost by reason of federal construction of the Ft. Gibson Dam.

The unanimous ruling written by Justice William O. Douglas reverses a decision by the US Court of Claims. The Court of Claims had upheld arguments by the Grand River Dam Authority, a state agency created to develop hydroelectric power on the non-navigable river. The State Authority claimed $10-million for the taking of water power rights and its franchise to develop electric power at Ft. Gibson site.

Justice Douglas ruled that Congress in 1941 had adopted a comprehensive plan to protect the navigable capacity of the Arkansas River, which included a three-dam coordinated project for the Grand River. Douglas said this bars the state's claim, because "when the United States appropriates the flow either of a navigable or a non-navigable stream pursuant to its superior power under the Commerce Clause, it is exercising prerogatives and is beholden to no one."

Oklahoma actually held no vested rights to the Ft. Gibson site, according to the Supreme Court. Therefore, said Douglas, the federal government "did not appropriate any business, contract, land, or property (of the State Authority) . . . the frustration of the Authority's plans and expectations which resulted when the United States chose to undertake the project on its own account did not take property from the Authority in the sense of the Fifth Amendment."

The Ft. Gibson Project, is part of a multipurpose plan for the Arkansas River basin.

Large Combined Cycle Unit Planned by Oklahoma G&E

Oklahoma Gas & Electric Co will have the nation's largest combined cycle steam-gas turbine generating unit, and the first such unit to optimize the ratio of steam-to-gas turbine capacity. The 200-plus-Mw unit is expected to cut at least 4% off the heat rate expected from a conventional steam unit of similar rating and steam conditions.

OG&E and General Electric Co feel the new development signals a significant advance in thermal plant design. GE has taken a prime contract for the plant. This is thought to be the first time in recent years a large electrical manufacturer has taken such a role for a major domestic generating plant outside the nuclear field.

GE has engaged Sargent & Luncy to design the plant, which is scheduled for completion in 1963.

DAN BRAYMER IN EUROPE—III

Germany Asks Bids for Atom Plant

German affiliates of US, French and British manufacturers are invited to bid on 200 to 300-Mw nuclear power plant

Essen, Germany — Rheinisch-Westfaelisches Elekrizitaetswerk (RWE), mammoth West German utility system, has invited bids from German affiliates of US, French, and British manufacturing firms on a 200 to 300-Mw single-unit nuclear power plant for possible installation in south Germany where it would supply power to pump-storage generating plants along the German-Swiss border. It is by no means a foregone conclusion that the atomic power plant will be built.

Like most other utilities on both sides of the Atlantic, RWE insists that its decision to build depends on whether the nuclear plant can compete economically with energy costs of hard-coal plants in the Ruhr on a guaranteed basis and whether manufacturers provide guarantees minimizing the financial risk to the utility. The installation, if built by RWE, will be privately financed by the German power company.

Ultimate decision on the nuclear plant will not be made for some time, although the bids are due in about four months. It will take an energy cost of nine mils per kwhr to compete with the hard-coal energy costs in the Ruhr valley, and the German utility insists that this cost be guaranteed and, probably, that the plant be built at a fixed cost.

RWE is now completing a 15-Mw (net) boiling-water, closed-cycle power reactor installation at Kahl just outside Frankfurt.

On a visit to the Kahl plant, I found it about 75% completed as of the end of May. Plans are to start fuel loading early in September and that the plant become critical that same month and operate on full power test by the end of the year. This installation is being built by the German Allgemeine Elektricitaets-Gesellschaft (AEG) with General Electric Co as consultant and nuclear equipment supplier.

Anticipated total cost to the RWE is approximately $8¾-million including sites, roadways, etc. and the plant is expected to produce power at about 2¼¢ per kwhr.

Nuclear portion of the plant is very much like the US Dresden installation but on a small scale. Initial operation will be at 15-Mw, however, with the installation of forced circulation. The plant will be potentially capable of generating 30-Mw from the second core. In this event a second steam unit will be necessary.

It is quite clear from discussions with utility people in both the Netherlands and Germany that the Western European utilities are in no mood today to install nuclear power plants unless they can be competitive with conventional generation. They will install only sizes economic for their systems and they insist on competitive energy costs and sufficient guarantees with respect to investment to make the economic risk nominal.

Today the Western European utilities seem unlikely to build plants under the Euratom program as it stands. The feeling seems to be that the Euratom program is a bit too rigid for the needs and interests of European utilities. First, it calls for 150-Mw plants, which are for some countries too large, for others not large enough.

Secondly, the program calls for turnkey plants built by an overseas nuclear industry. But European utilities favor the creation of a nuclear industry in their own countries rather than purchase of turnkey plants from abroad. They are far more apt to buy know-how than package plants. This doesn't mean that a few overseas nuclear plants will not be purchased but that they will not be purchased under the Euratom program, but rather on a negotiated basis suitable to the individual company or group.

Thirdly, the view has been expressed that 1960 interest rates in Western Europe, particularly Germany, favor domestic financing of nuclear plants more than they did when the Euratom program was launched. Interest rates under the Euratom program are still better than those in Europe, but the margin has been closed significantly.

Heidelberg, Germany — AEG's Dr Boll reports that switching surges on German 380-kv systems range between 1.9 and 2.1 times line-to-neutral voltage.

Contamination of insulators, on the other hand, is becoming a difficult problem, particularly in industrial areas. Washing of insulators is practiced at some 380-kv stations, and there is experimentation in the design of Langstaub 380-kv insulators to cut down the effects of fog and contamination.

German transmission designers today are seeking to reduce the 55 deg swing angle requirement that is being imposed upon them by their equivalent of the US National Electric Safety Code. On European systems 55 deg is considered too large an angle, completely out of keeping with experience. It is surprising to find little or no evidence of high lightning outage rates on European 380-kv transmission lines, although tower heights are normally 150 ft and carry only a single ground wire on a piece that appears to be 8 to 10 ft above the top arm.

TRAVELING EDITOR Dan Braymer stands before a German nuclear power plant at Kahl, near Frankfurt

Chilean Utilities Dig Out and Repair

WRECKED BUILDINGS attract the stunned gaze of Valdivia residents after quake. Flooding damaged more

Southern Chile electric utilities are beginning to bring order out of the chaos of the severe earthquakes that occurred late last month. Curiously enough, damage to generating facilities was comparatively light even though the earthquakes made topographic changes in the area. Distribution systems were wiped out to the extent that even reduced generation was sufficient to supply areas that had distribution facilities in operating condition.

Hydroelectric plants of Empresa Nacional de Electricidad Endesa suffered some leaking that was relatively easy to repair. Water feeders in the company's Abanico plant near Concepcion and Pilmaiquen plant were broken putting both out of operation. Pilmaiquen was partially flooded, and four of its five units were inoperative.

Endesa restored partial operation by working day and night for two days to get three units on the line. The four units were then able to supply more than enough electricity for the usable distribution system. Day and night work on other repairs continued on through mid-June.

Estimates of damage to distribution systems are still incomplete.

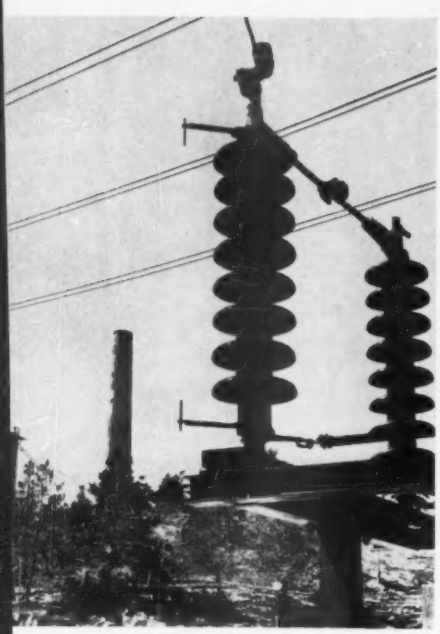
Some $21 million damage was done to industries in the 10 stricken provinces. This amounts to about 20% of Chile's total industry. Some 18,700 housing units were completely destroyed.

Much of the more serious damage occurred when slides blocked the San Pedro River. The river drains Lake Rinihue, near Valdivia, and the lack of drainage caused the lake to overflow, inundating several neighboring villages, including Valdivia. Three places in the river course were blocked.

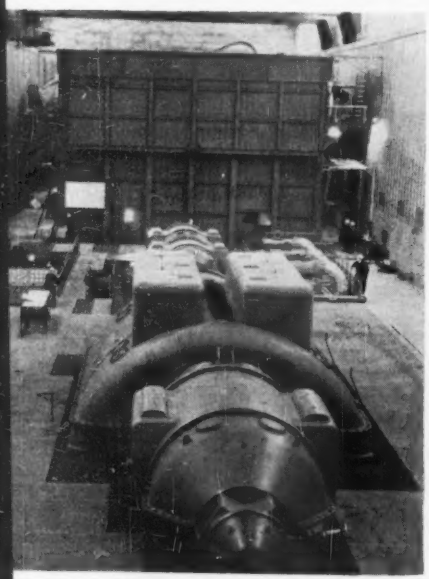
BROKEN LAMP POST is evidence of utility damage at Concepcion May 22

SOLDIER STANDS GUARD over remains of an electrical shop in Concepcion. Wire reels can be seen near the entrance of the building, above a pile of rubble

Underground Steam Plant on Line



ABOVE THE GROUND, all that is visible are the main switchyard and stack



FIRST COMPLETE BAY contains boiler, high and low pressure turbines

First 150,000-kw unit is forerunner to others that will bring plant capacity to 700,000 kw by end of this decade

The first 150,000-kw section at the Swedish State Power Board's new underground Stenungsund steam-power plant on the West Coast north of Gothenburg has been placed in operation. A second section of the same size will be in operation this autumn. When fully completed towards the end of this decade, the 700,000-kw Stenungsund facility will be Sweden's largest power plant—compared with 400,000 kw for the new Stornorrfors hydroelectric station—and probably the biggest underground steam-power plant in the world.

Construction Started in 1955

Initial construction work on the Stenungsund plant was started in 1955. At that time, plans called for the construction of only two sections of 100,000 kw each, but as the project commenced it was found feasible to increase power capacity through new designs, the introduction of intermediate steam overheating, etc., and it was decided to include two additional sections in the overall plan.

The new plant is entirely encased in the solid bedrock of a mountain just outside the community of Stenungsund. The only visible parts above ground are the smokestacks towering 280 ft above ground level and 490 ft above sea level, and the main switchgear plant, which feeds the 130-kv power into the grid network.

The design and construction of the Stenungsund plant was carried out by the Swedish State Power Board, with mechanical equipment supplied by a number of leading Swedish industrial firms. These include Stal (de Laval Ljungstrom) who supplied the largest turbine plant ever built by the company; Svenska Maskinverken, the boilers, and Svenska Flaktfabriken, designers of the extensive ventilation equipment. Asea supplied transformers, switchgear and other equipment, while Nordarmatar provided high pressure valves.

Excavation Was From Solid Rock

Construction work for the new plant required the removal of 1,200,000-1,570,000 cu yds of rock for the four underground machinery halls, access tunnels, etc. Each of the two halls in the first building stage has a length of 410 ft, a width of 69 ft, and a height of 98 ft, while the two remaining bays are somewhat larger.

Each machinery hall forms a separate unit and includes a ventilation section, boiler, high and low pressure turbines, generator and transformer. Ventilation equipment has a capacity of 1,260 tons of air per hour. The unit for separating solid particles in the smoke gases treats 908,000 cu m of gas an hour with a purification degree of 90%. Sea water is used for cooling and the 3-km tunnels have a capacity of 40 cu m per second.

Boilers Use Bunker C Type Oil

Each boiler consumes about 35 tons of Bunker C type oil per hour, and the peak temperature at the 16 burners is 1,700 C. The volume of steam in the boiler and overheater amounts to about 450 tons an hour at temperatures up to 530 C. The boilers are of the horizontal type and are provided with conventional components, such as preheater and economizer. From the boiler the steam is conducted to the high-pressure turbine and back again for intermediate heating before being fed into the low-pressure turbine.

in Sweden

This system is claimed to insure improved operational economy, although it involves a somewhat longer starting-up period.

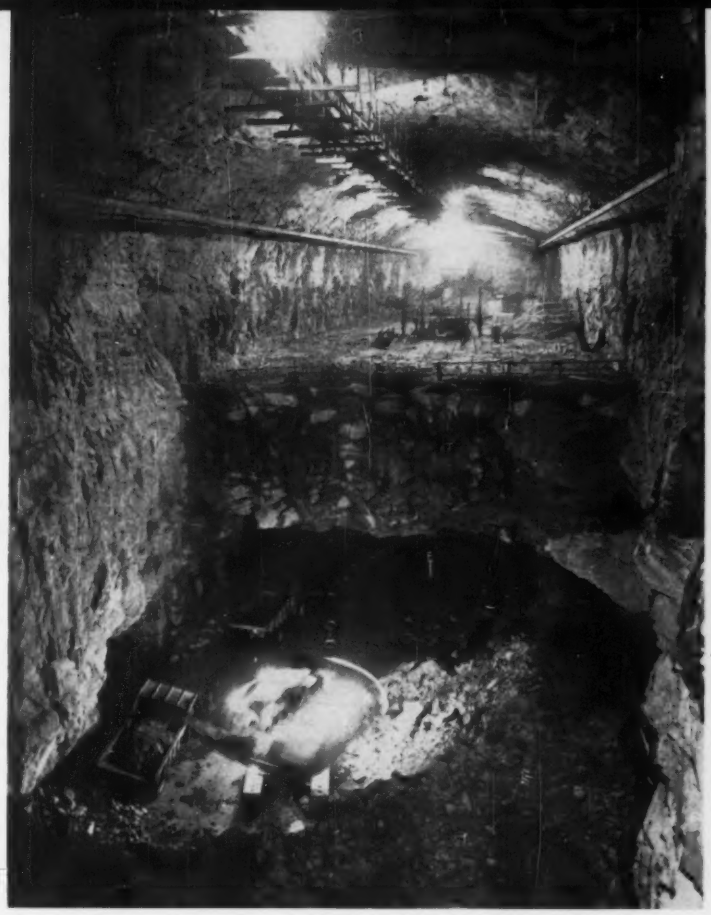
The Stal turbogenerators, of which the high-pressure unit has a rating of 39,000 kw and the low-pressure unit a rating of 111,000 kw, are of essentially new design. Both are designed for a speed of 3,000 rpm. For the first time in Sweden, hydrogen has been introduced as a cooling medium.

A joint automatic control room, situated between the two machinery halls, serves the first and second sections.

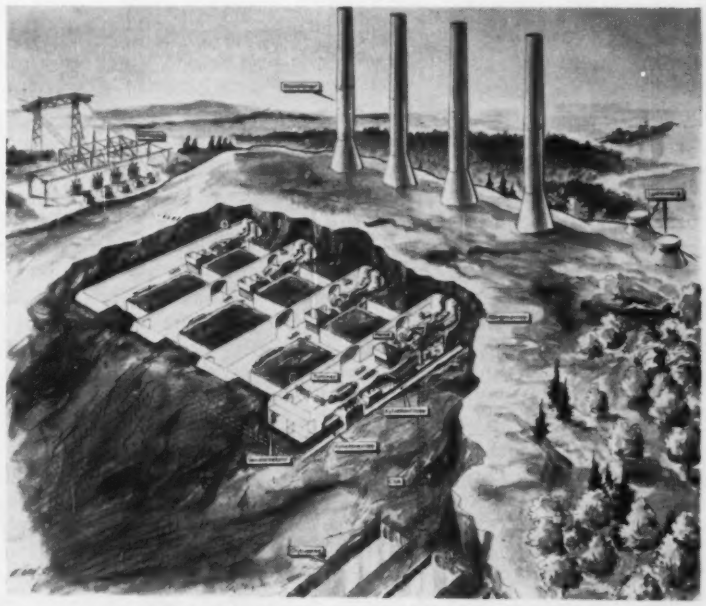
Special Oil Handling Facilities

The oil required for the operation of the Stenungsund plant is discharged at a special harbor, about a mile from the plant proper. It consists of a pier and an access bridge of almost equal length. Tankers of up to 65,000 tons can be accommodated on either side of the pier. From the harbor, which was built by the contractors Skanska Cementgjuteriet, the oil is pumped into tanks blasted out of the rock. Great care has been taken to prevent spill oil from polluting the sea water in this area, which is a popular seaside resort.

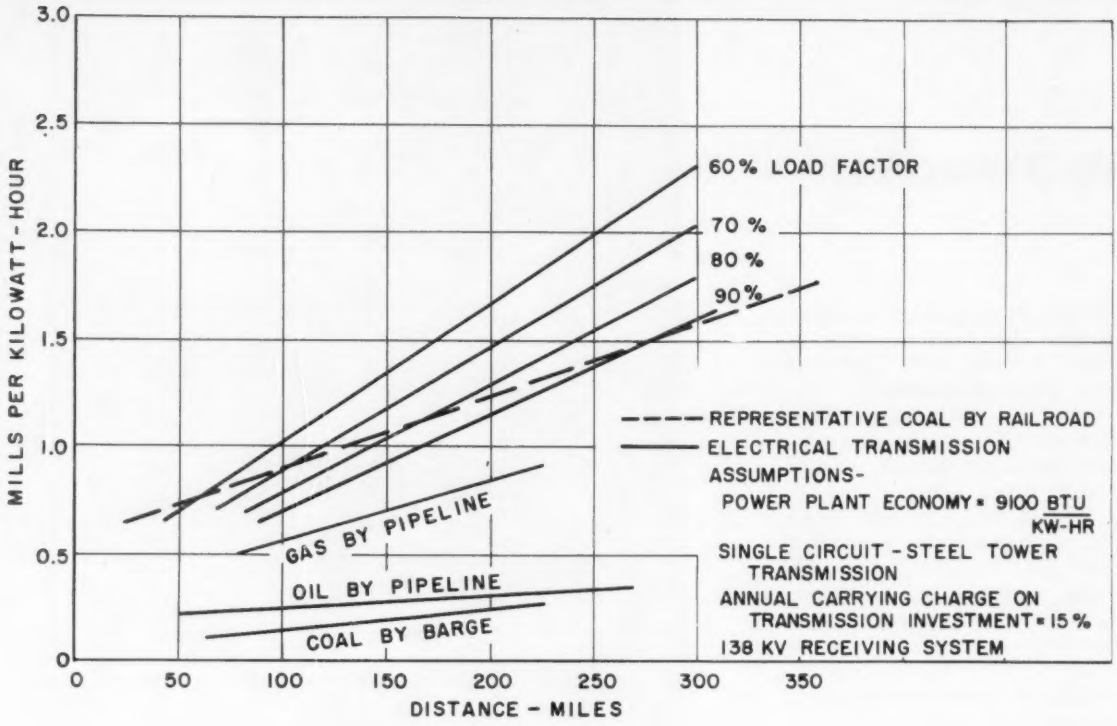
When the first building stage of the Stenungsund plant is completed this autumn with the placing in operation of the second section, some $40,000,000 will have been invested by the Swedish State Power Board in this project. It will then have doubled the Board's thermal power capacity in less than one year's time. Although thermal power normally accounts for less than 5% of Sweden's total annual power output, in years of drought it can rise to 10 to 15%. During the past few months, following exceptionally dry summer and autumn, thermal power has accounted for about one-third of total power production.



DURING BLASTING STAGE the machine hall and space for cooling water pools looked like this at the Stenungsund generating station



FOUR MACHINERY BAYS and an ultimate capacity of 700,000 kw will make Stenungsund Sweden's largest plant when it is completed in 1970



COMPARISON OF PRESENT ENERGY DELIVERY COSTS shows 200-mile breakeven point for coal sent by rail and electric energy transmitted at high load factor. Series capacitors improve load-carrying capacities for longer lines

High-Voltage Series Capacitors

Longer transmission, higher right-of-way costs to call for wider use; to supplement low-reactance major units

S. B. CRARY, System Analysis Engineer, Electric Utility Engineering, General Electric Co, Schenectady, N. Y.

Series capacitors are expected to become more competitive for increasing high voltage transmission line stability and load capacity. High costs of rights of way, low capacitor costs, favorable experience and continued resort to long-distance transmission all point to their wider application.

Economic comparisons with other methods of increasing stability and load-carrying ability today favor series capacitors for transmission distances of 200 miles or more. Reductions in this breakeven distance for series capacitors should result from higher costs of rights of way. As system loading increases, generators and step-up transformers with lower-than-normal reactances first become economic. This initial step is followed by effective use of series capacitors at $8 to $10 per kvar to supplement generator and transformer reactances made as low as feasible. In a well-balanced transmission design, therefore, there is economical need for both series capacitors and low reactance major equipment. The most economic circuit loading for above 250 miles is at about the surge impedance level.

Economic studies indicate an almost linear relationship between cost of transmission and distance. These studies also provide comparisons between the costs of electrical transmission and those of other methods of transmitting energy. Electrical load factor is very important in such cost comparisons. High load factor may very well result in straightaway electrical transmission becoming more economical than transportation of coal by rail over equal distances, even for those exceeding 200 miles where the chart shows coal transportation hard to beat.

Cost comparisons have shown that series capacitor compensation is unnecessary to obtain the most economic transmission for short lines. But it is necessary for a 600-mile line, and its cost is less than 10% of the total cost.

It has also been shown that multiple conductors per phase have resulted in an overall saving as compared with single conductors. The use of multiple conductors can be expected to be further evaluated for different conditions in this country, along with the economics of lower resistance single conductors.

The linear increase of electrical

Installed High Voltage Series Capacitor Banks

Date Installed	Location	Rated Kv	Rated Kvar + Estimate for Future	Reinsertion Gap: High or Low Speed
1950	Sweden	230	30,000	Low
1951	Chehalis, Bonneville Power Admin.	230	36,630 In service at Hot Springs	High
1951	St. Andrews, Bonneville Power Admin.	230	36,000	High
1951	Rocky Ford, Bonneville Power Admin.	230	59,400	High
1954	Sweden	400	2 in same line, 105,000 each	Low
1954	Dept. of Water and Power, City of Los Angeles	287	15,000	High
1956	Sweden	400	95,000	High
1956	U. S. S. R., Kuibyshev—Moscow	400	480,000 (1750 amp, 520 ohms) Existing installation on 220,110 and 35 kv	Low
1956	Japan	230	50,800	High
1957	Louisiana Power and Light	115	57,800	Low
1960	Bonneville Power Administration	345	108,000	Low

Show More Promise

transmission over long distances is a result of the use of series capacitors up to 75% of line reactance. The characteristics obtained with series capacitors have been invaluable as a benchmark in estimating the cost of high-voltage transmission. Comparisons can be made quite readily between the use of series capacitors at $8 to $10 per kvar and other means. In particular, comparisons can be made with the use of generators and transformers with reactances lower than normal, with multiple conductors, and with the use of special generator-excitation systems.

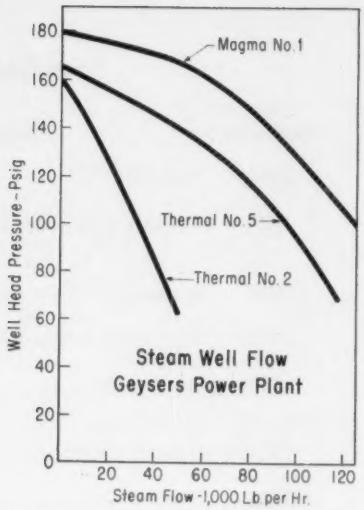
Series capacitors have been applied to improve thermal capability and efficiency of transmission by controlling load division between parallel circuits, for reduction in light flicker, and for other voltage control applications, as well as for stability.

An experimental series bank has been in service at 287 kv for several years. The Swedish and Bonneville power systems, and more recently the Soviet Union, have used series capacitors of considerable kvar as an integral part of system designs. These systems and those in Japan are expected to extend their use of high-voltage series capacitors within the next few years. Installations of about a million kvar, shown in the table, include a large capacity for parallel line loading in addition to that for stability control. The average added annual capacity has run about 100,000 kvar. Operations of installed banks is providing worthwhile information with regard to reliability and performance.

Analytical Methods Found

In the early stages in the development and application of this equipment, there were several system difficulties, including the complex phenomena of self-excitation. An adequate theory and method of analysis for series capacitor installations was developed satisfactorily, however. With a sound analytical method it became possible to determine stable limits of compensation of high voltage lines as well as the effects of rotating loads and of static equipment.

It is expected that series capacitors will continue to be used on long transmission lines, switched, and with or without intermediate switching stations. Their voltage and thermal limits have been standardized. Also high-speed protective gaps are very desirable to realize the maximum power transfer and thus the greatest economy. The high-speed controlled-arc gap is preferred to the lower speed gap, particularly if stability is a limitation. Methods for transmission line relaying and control of switching operations have been developed very satisfactorily.



STEAM FLOW from Geysers was plotted from PG&E 1958 test data

STEAM is collected from wells for delivery at plant at 114 psig, 248F

Natural Steam Source Harnessed

Geysers in California become energy source for PG&E's 12.5-Mw turbine-generator — first such project in US

A. W. BRUCE, Supervising Mechanical Engineer, Pacific Gas & Electric Co, San Francisco, Calif.

Natural steam from the earth for the first time in the US generated commercial electric power when Pacific Gas & Electric Co's 12,500-kw turbine-generator recently began operation. More generating facilities will be installed as the steam supply from the Geysers, 95 miles north of San Francisco, is developed.

Cost of the production plant, with its step-up switchyard, is $1,750,000. The ten-mile, 60-kv transmission line will cost another $250,000. PG&E will pay for steam delivered to the plant at 2.5 mils per net kwhr of electric energy delivered to the company's system from the first two units and an escalated price for energy from any additional units.

Geologists expressed little doubt that the heat supply from the magma of the earth will be sufficient long enough to make the project economic. The amount of water from which steam can be produced has not been determined. Steam produced from the magma, known as magmatic steam, should continue undiminished. The supply of meteoric steam produced from water that falls as rain and percolates through the ground could decrease following adverse water years. But wells drilled in 1922-25 are reported to be producing at the same volume as when first drilled. Fumaroles—holes in the earth giving off hot gases and vapors—have been known for over 100 years in Sonoma County.

NATURAL STEAM is piped from the Geysers Power Plant. Turbine building is shown in the left middle ground with the cooling towers across the road

ELECTRICAL ENERGY goes by means of new ten-mile 60-kv transmission line, shown in foreground, to the Pacific G&E system. This $250,000 transmission line was built for a capacity of 34 Mva. It ties into two older circuits

For Commercial Electric Power

In pinpointing the special problems in the use of geothermal steam for generating power, experiences of the Italians at Larderello, reports from New Zealand, and the 1957 reports on the Geysers by Allen and Day for the Carnegie Institute were studied.

The information obtained from Allen and Day report and a report on a 1956 test of the gases in the steam were consulted in feasibility study. It was realized, however, that additional tests were necessary for specifying the sizes of gas removing equipment and the least expensive materials for such equipment. The tests were performed July-October 1958 by PG&E's bureau of tests and inspections.

The first test was on three steam wells, Magma No. 1, Thermal No. 2 and 5, at varying pressures to determine the quantity and enthalpy (heat content). The steam flow at 115 psig at wellhead for the three wells was 219,000 lb per hr. Enthalpy was 1,199 to 1,207 Btu per lb of steam.

The test was made to determine the percentage of non-condensable gases in the steam. Steam and gas seem to come from a common source to all the wells, as the percentages in each well were found to be nearly the same. As non-condensable gases averaged 0.75% by weight, it was decided to use 1.0% for gas removal equipment design. Most of the gas is carbon dioxide, methane, hydrogen, nitrogen, hydrogen sulfide, and ammonia being present in smaller amounts. Average molecular weight is 34.37.

Corrosion Measured

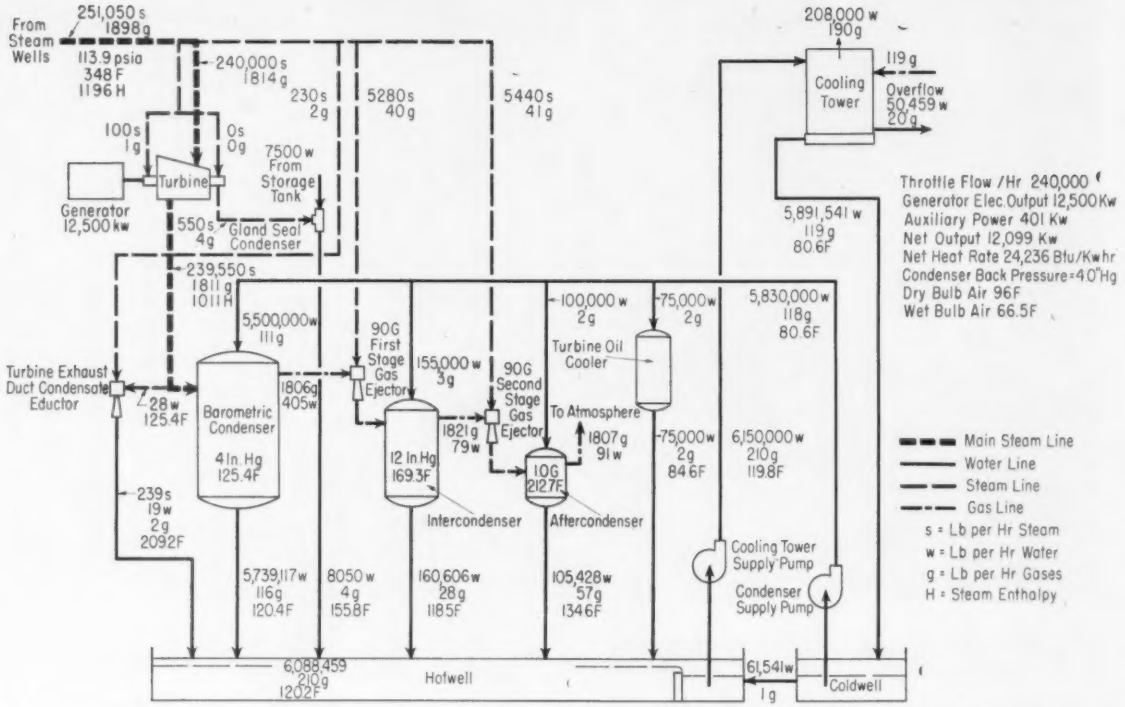
The main objective in testing was to determine the corrosive effects of the steam, condensate, circulating water, and the atmosphere from the cooling tower. A small scale model (to 1/770 size) was constructed. It represented the plant cycle from the turbine exhaust to the barometric condensers, gas ejectors, and cooling tower, and was for use with a corrosometer for measuring quickly the effect of corrosion on various materials.

Tests determined that carbon steel could be used for dry steam lines, and stainless steel, Type 304 or 316, for steam condensate lines. In the barometric condenser lining, gas ejectors, inter and after-condensers, Type 316 stainless steel should be used. For the circulating water lines, concrete pipe covered inside and outside with a coal tar enamel could be used. For circulating water lines not buried in the ground, aluminum pipe of Type 3003, 5052 or 6061 seemed best. In the atmosphere from the cooling tower, aluminum stood up well but copper corroded quickly. No copper will be used in the plant where it is directly exposed.

The principal differences between the usual modern power plant and a geothermal one are:

1. There is no boiler. Steam condensate is not recycled but is used for cooling water makeup
2. Steam pressures are lower
3. The steam has much larger quantities of non-condensable gases which must be removed from the condensers to maintain vacuum.

It is characteristic of flow from a steam well that pressure drops with an increase in flow. Therefore, there is a point at which the most power can be obtained with a combination of available flow and pressure. It was decided that a pressure of 100



FLOW DIAGRAM INDICATES graphically utilization of the low steam pressure available from the earth source for the most economical heat balance. Less water is lost by evaporation than supplied by condensed steam

psig would be used in the first unit.

As it was not necessary to return the steam condensate, it was decided to use the less expensive barometric condenser wherein the condensing steam and cooling water mix. Steam enters the bottom of the condenser, and cooling water the top. In dropping over discs and doughnut baffles, the water condenses the rising steam. The mixture then falls down a barometric leg into a hotwell and is pumped to a cooling tower, where it is cooled from 120 to 80F by evaporation.

An important feature of the cooling cycle is that less water is lost by evaporation than is supplied by the condensed steam. This means that external makeup is only required for filling the cooling system initially. The amount overflowing from the cooling tower is 12 to 40% of the steam condensate, depending upon atmospheric conditions. The greatest amount is obtained during the cooler periods of the day or season.

The non-condensable gases in the steam require gas ejecting equipment of much greater capacity than that in conventional units. Because of its lower cost, steam jet equipment will be used instead of mechanical pumps.

The steam, as it comes from the well, contains solids which could accelerate wear of the turbine blades. As a part of the contract, the steam suppliers will remove all the particular matter separable by equipment commercially available.

Tubes Are Aluminum

The flow diagram for the cycle shows that the total steam supply to the unit is 251,050 lb per hr. The turbine is supplied with 240,000 lb per hr of the 100-psi, 348F steam. The first stage jet will require 5,280 lb per hr and the second stage 5,440 lb per hr. For the turbine exhaust duct exhaust eductor 230 lb per hr is used. The main barometric condenser uses 11,000 gpm of 80F cooling water. Flow to the inter-condenser is 310 gpm and to the after-condenser 200 gpm. An economic study of the best vacuum for the condenser indicated 4 in. Hg absolute. A better vacuum would involve more cooling water, more gas ejector steam, larger circulating water pumps, and a larger cooling tower.

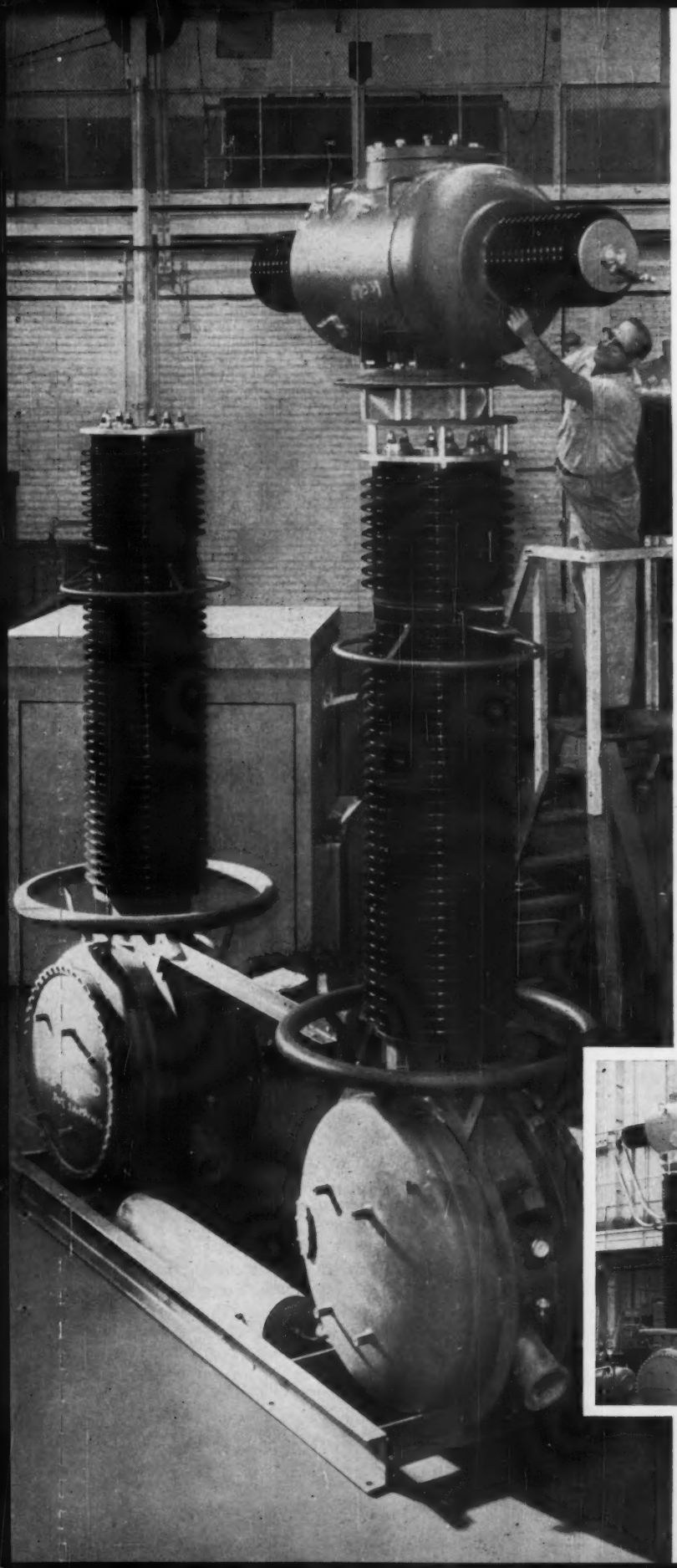
The turbine-generator oil cooler requires 150 gpm of cooling water. As it uses water from the main circulating system, aluminum tube sheets and tubes are used. The cast iron water box has been coated with an epoxy resin paint to reduce corrosion.

The power plant site is on the north side of Big Sulphur Creek, the steam wells being 1,495 ft above sea level. The area limits the units to two.

The power plant building is of rigid steel frame design, 31 by 77 ft in plan, with an even height of about 30 ft. Besides the main unit, it will house the main control board at the turbine end and the switchgear, exciter, battery, and other electric auxiliaries at the generator end. A 20-ton electric crane was provided for initial erection and for maintenance of the turbine. The building is sheathed with fluted, colored aluminum siding.

On its south side is a concrete block building for housing the office, change room, maintenance shop, and storeroom.

The turbine generator is at ground level, which saves consider-



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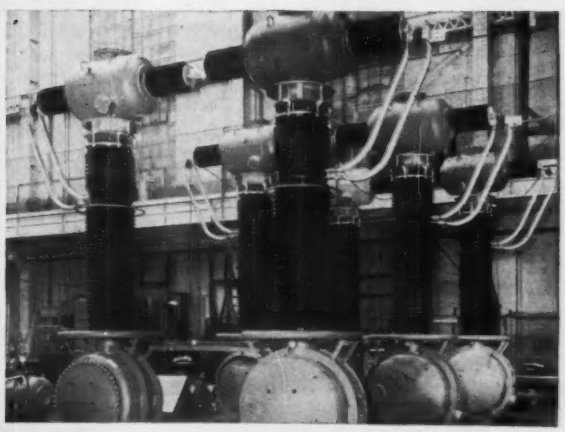

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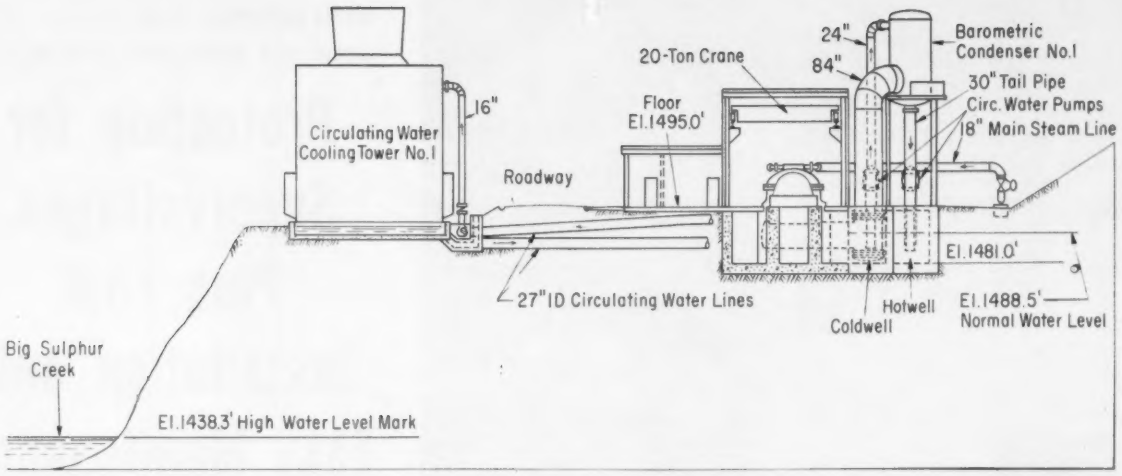


ELEVATION of Geyser Power Plant is shown on its site on the north side of Big Sulphur Creek. The steam wells, not shown, are at 1,495 ft above sea level. Cooling towers are adjacent to creek and 5 ft below plant elevations

ably on the height of the building, although requiring a partial basement for the turbine exhaust duct. There was available a 12,500-kw turbine-generator, installed in 1924 at the PG&E's Sacramento Power Plant. Its steam conditions are 175 psig with 100F superheat and 1½ in. Hg absolute backpressure. For the new steam conditions of 100 psig and 348F inlet steam conditions and a backpressure of 4 in. Hg absolute, many changes were made.

The turbine was a nine-stage, 1,800-rpm, single-casing, condensing machine. It was opened by removing the first three stages and enlarging the eighth and ninth stage buckets to permit more flow. The remaining six diaphragms were replaced on the belief that copper brazing in the original construction would be deteriorated by hydrogen sulfide in the steam. The monel buckets in the fourth to seventh stages were retained, as no mercury, believed harmful to monel, was found in the steam.

It is thought that there is fine mineral matter in the steam, although dust eliminators were installed in the steam lines from the wells. For this reason, the control valves were replaced by two butterfly valves, 10 and 6 in. Because the stem of the turbine throttle valve could stick, an emergency stop valve of the swing check type has been installed after the throttle valve. Simultaneous tripping of the two valves insures positive steam stoppage.

A condensing turbine was selected because it provides about twice the electrical output per lb of steam as one which exhausts to the atmosphere. A barometric condenser, in which the steam is condensed by mixing with cooling water, is used. As it is not necessary to save condensate, this makes a simple way to provide the cooling tower makeup requirements. It also makes possible a less expensive means of degassing the condensate than by means of a surface condenser.

The condenser vessel is 10 ft dia and 23 ft high, with an 84-in. steam inlet. The cooling water inlet at the top is 24-in. and a 30-in. water outlet is connected to the 30-ft barometric leg.

Gas Ejectors Large

The gas ejectors are considerably larger than a conventional unit's because of the much greater amounts of gases to be handled. A two-stage gas ejector with inter and after condensers is used.

The condensers were fabricated from carbon steel with an inside cladding of Type 316 stainless steel. The gas ejectors, connecting piping and internal parts of the condensers, were fabricated of solid Type 316 stainless steel.

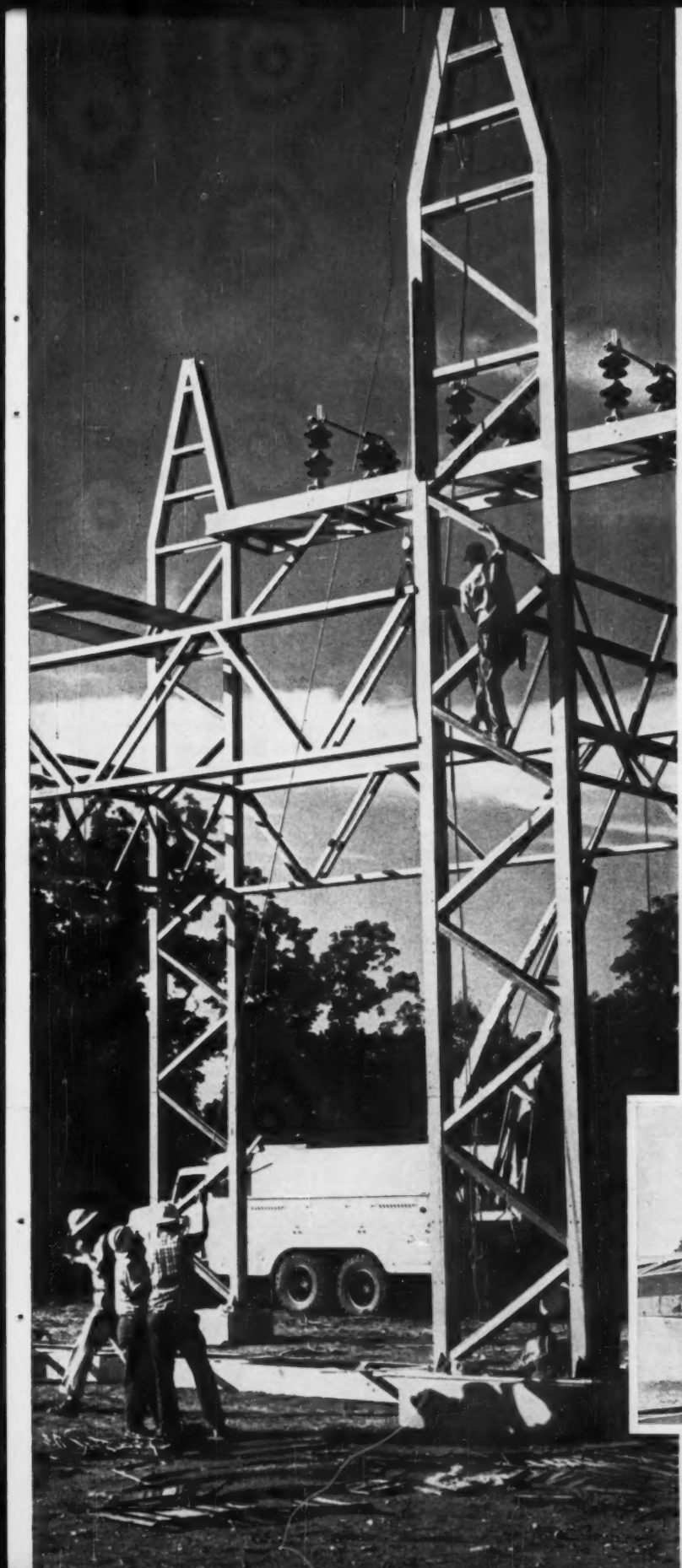
The circulating water pumps are the vertical turbine type, all parts in contact with water being made of Type 316 stainless steel. One full-size condenser supply pump with a capacity of 11,600 gpm at 29-ft head takes suction from the coldwell. The cooling tower supply pump, also full size and taking suction from the hotwell, has a capacity of 12,300 gpm at 50-ft head.

The cooling towers are adjacent to the creek and 5 ft below the plant elevations. They provide cooled water by gravity flow through a 27-in. reinforced-concrete pipe to the coldwell sump for the pump which supplies water to the condenser. After falling through the barometric condenser, thus condensing the steam, the water is picked up from the hotwell and pumped back to the cooling tower to be cooled and recycled.

The cooling towers are of standard induced-draft type with three cells, and are designed to cool 12,000 gpm of water from 120 to 80F, a wet-bulb thermometer reading 65F. Special attention has been given to offset corrosive effects of the water. Plastic fill of polystyrene and stainless steel hardware are used. The cast iron in the column anchors and inlet water pipes are Heresite coated. The basin of the cooling towers is reinforced concrete, having a coal-tar coating. Structural members are redwood and transite is used for the siding and deck covering for greater protection against forest-fire embers.

Due to favorable meteorological conditions, the cooling towers are operated with a continuous blowdown of 58 gpm on a 110F day, changing to 190 gpm on a 35F day. This keeps the buildup of chemicals in the water to a low limit. Most

(*Continued on page* 146)



CO-ORDINATED DESIGN, MANUFACTURE AND SHIPMENT MEAN YOU CAN . . .

Cut Installation Time and Costs With General Electric Outdoor Stations

You can reduce installation time, cost and worry when you buy a complete outdoor station from General Electric. Here's why:

- **There are no "bottleneck"** parts to wait for, and no "forgotten" items. Components are either in stock, or can be manufactured repetitively to meet your exact specifications.
- **Components are shipped** to coincide with your construction schedule. "Piecemeal" shipments are avoided.
- **All electrical and structural items** are co-ordinated mechanically and electrically because you are purchasing from one manufacturer.

To meet your individual requirements, you have a choice of lattice-work structures or rolled-shape columns of aluminum or galvanized steel.

Why settle for less? For more information, contact your G-E Sales Engineer. Or write to Section 495-12, General Electric Co., Schenectady 5, N. Y.

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LATTICE-TYPE ALUMINUM STRUCTURE used for station illustrated is light enough to be handled manually. Station structure was erected in one working day.

NELPA Meeting Hears Test Plans

Missoula conference told how model will combine thermoelectric generator and thermionic device heated from nuclear fission

D. J. PAVEJSIL demonstrates high temperature to which materials may be subjected in direct power conversion

A model for testing a thermoelectric generator combined with a thermionic device heated from nuclear fission is being constructed by Westinghouse Electric Corp, the Northwest Electric Light & Power Association was told at its spring conference at Missoula, Mont.

In this model, fuel elements will be encapsulated in a material emitting electrons, thus fulfilling the conditions for the cathode, said D. J. Pavejsil, adding that this "cathode" will be separated from the anode by gas plasma.

The wall thus becomes the anode of the thermionic device, he said, and is hot enough to be the hot junction of a solid thermoelectric generator. The cold junction, he added, is the reactor coolant. The two devices, then in electrical series, will operate over a wide temperature range from incandescence to reactor coolant limits.

Pavejsil gave a demonstration of the temperatures to which materials may be subjected in direct power conversion methods and pointed out that fuel cells, employing low-cost fuels, can function in a temperature around 1,800F. Thermoelectric generators, he said, operate near 2,000F, and the thermionic generator close to 3,000F. He demonstrated that the operating temperature of a magnetohydrodynamic (MHD) generator is near 5,000F.

Ceramic meterials, generally of low ductility and low tensile strength, withstand these high temperatures, he said, but must be used in systems without moving parts. For thermoelectric devices, a reactor offers an ideal heat source, he said.

A reactor, he said, is a static device, allowing the use of materials of comparatively low tensile strength, is capable of generating high temperatures within the uranium fuel, and may have a low temperature coolant.

70% Efficiency Likely

Fuel cell efficiencies are not limited by the Carnot cycle and could reach 100%, said A. W. Moody, General Electric Co. But an efficiency in the order of 70%, he added, is more likely in the near future.

Noting that direct-conversion devices cost an additional $40 to $50 per kw in conversion to ac power, Moody declared that all such devices are years off from practical application and are in competition with a "moving target" as conventional generation constantly improves.

Puget Sound Power & Light Co has no age limitations on hiring, each applicant being considered for his personal suitabilty, said Frank Baker. His company, he said, has hired persons as old as 63, although retirement is mandatory at 65. An experienced engineer, he noted, is usually more valuable to the company than a young one, being more concerned with what he himself brings to his job.

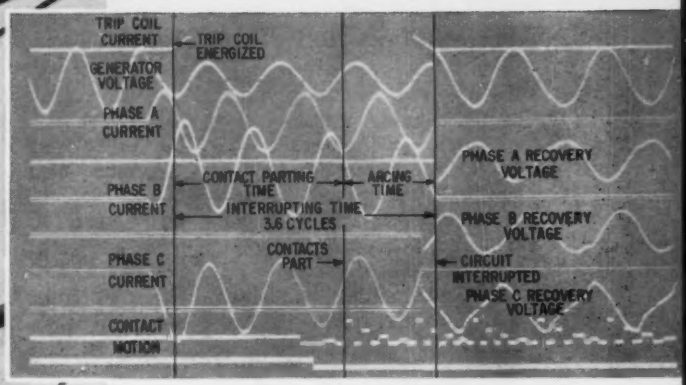
Computer analysis of loads and resources is expected to increase considerably the efficiency of the Northwest Power Pool's operation, said E. F. Timme. Handling of more data, he said, allows consideration of the probablity of stream flow.

Loads are drops only as necessary to correct trouble, but in an emergency area loads are dropped without delay.

Loads in areas of steam-unit generation are dropped before low voltage and low frequency become severe, frequency relays and undervoltage devices graduating the load drop and minimizing interruptions.

Load drops are accomplished selectively so as to cause the least difficulty with the various load types, especially as blocks of 20 to 200 Mw

(*Continued on page* 54)



Five-cycle performance of G-E one-tank sub-transmission breakers is demonstrated in the oscillogram above. Conventional breakers are rated to interrupt in eight cycles. Photo shows one of 17 G-E one-tank breakers installed by The Potomac Edison Company, Hagerstown, Md.

WITH GENERAL ELECTRIC ONE-TANK SUB-TRANSMISSION BREAKERS, YOU CAN . . .

Cut Interruption Time to Five Cycles

Five-cycle performance of General Electric's one-tank sub-transmission breakers (15 kv through 46 kv) provides superior system protection. This is a full three cycles faster than industry requirements for breakers of this class. Here's what quicker interruption means to you:

- Chances of line burn-down are reduced;
- Inspections and maintenance can be reduced, because oil carbonization and contact wear are minimized.

Five-cycle interruption is possible because of the interrupter efficiency and compactness of the G-E one-tank breaker. Since linkages are shorter and lighter, contacts part in 2½ cycles or less. Field-proven oil-blast interrupters also help decrease interrupting time.

Why settle for less? For more information, contact your G-E Sales Engineer. Or write to Section 494-01, General Electric Co., Schenectady 5, N. Y.

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GENERAL ELECTRIC

NELPA Meeting Hears Test Plans (*Continued from page 52*)

may be involved, Timme declared.

All participating utilities coordinate, and pool operation is brought to normal as promptly as practicable.

Gas turbine generating units can be supplied with a special coupling which enables the generator to operate as a synchronized condenser, said A. C. Conger, Brown Boveri Corp. The switch from generating to condensing operation takes place without stopping the unit.

Thus application is suitable to peaking generation and to firming up capacity, as well as to emergency use, Conger noted. Judging by design and devolpment progress, he said, units as large as 50 Mw will be available soon.

Utilities should give electric heat to the people because they want it and should charge what it costs them, said R. J. O'Connor, Idaho Power Co. He emphasized that in selling electric heat, the utilities are also selling the totally electric home.

Charles Kerr Jr, Westinghouse Electric Corp, urged utilities to "be smart enough" to find a place for the electric automobile in their changing pattern of personal transportation.

Each electric automobile, used as a second car at ½ kwhr per mile, he said, means the equivalent of the load of another house to the utility. It should sell for not more than $1,-300, he added, to appeal to families wanting second and third cars.

Fuel costs, he said, amount to half or a quarter of those of a gasoline engine, operation is quiet and vibration-free, and a host of troubles is eliminated, besides there being no contaminiating fumes.

All ingredients, except low price, make electrical trucks feasible for multi-stop service, he said, noting that this puts truck operational costs at 10 to 12¢ a mile.

Sheldon Station Design REML Topic

Prolonged negotiations with the Atomic Energy Commission drew uncertainty over the early design stages of Sheldon Station, the Rocky Mountain Electrical League was told recently at Boulder, Colo.

Engineering decisions on the station being built for Consumers Public Power District of Columbus, Neb., were delayed, resulting in a compromise on steam conditions, said T. E. Metcalf, Stearns-Roger Mfg Co.

Preliminary engineering studies, he said, showed that an 1,800-psig, 1,000F reheat cycle was most feasible for the conventional unit of the two-unit plant. The alternative was the steam that could be made available from a nuclear heat source at 800 psig, 825F, or 850 psig, 900F. Selection of the higher temperature and pressure involved the compromise in the design of the turbine-generator and boiler, Metcalf said.

T. E. METCALF points out details in model of Sheldon Station which is being constructed by his company, Stearns-Roger, for Public Power District of Columbus

Thus, for initial operation, Boiler 2 will supply steam without reheat at 850 psig, 900F to Turbine-generator 1, although the latter was basically designed for 1,450 psig, 1,000F reheat operation, he pointed out. About a year after the beginning of initial operation of the plant, the sodium graphite reactor at the nearby Hallam Nuclear Power Facility is expected to become operative, he continued, adding that at that time Boiler 2 will be placed on standby.

When HNPF becomes a reliable heat source, the boiler will be modified to operate with Turbine-generator 2 at 1,800 psig, 1,000F reheat, he said. At the end of the reactor's demonstration period, Boiler 1 could be installed to operate with Turbine-generator 1 on the 1,450 psig, 1,000F/1,000F cycle.

Such combinations, Metcalf said, were carefully considered in the design of the main steam piping, so that modifications will involve a minimum of scrapping of the expensive alloy pipe. Likewise, investment in 1,800-psig piping on the first unit has been minimized, he said.

The effects of overloaded distribution transformers on system costs have been overemphasized, said C. F. Mitchell, R T & E Corp. Of equal importance, he added, is the tendency to underload, resulting in higher capital costs.

A properly designed report derived from customers' kwhr consumption data, he said, provides an indication of transformer loading at regular intervals and shows what proportion of the distribution plant is used at optimum capability. Such a report, comparing similar neighborhoods, enables a utility to plan with less risk of putting in too much or too little capacity, he said. Such data also reduces the risk of failure when a transformer must be more heavily loaded, so that its deterioration is thus accelerated, he said.

GENERAL ELECTRIC RF-2 DISCONNECT SWITCHES PROVIDE . . .

Year 'round Dependability — Anywhere

You can depend on General Electric RF-2 disconnect switches to perform within their rating anytime, anywhere. Here's why—every rating, whether 7.5 kv or 345 kv, must run the gamut of testing extremes ranging from mechanical life tests to grueling ice tests.

Design features which contribute to the dependability of the G-E RF-2 switch include:

- **Silver-plated current transfer points** throughout the switch to provide long life;
- **One-piece switch blade** with formed contact end to eliminate the current-transfer point of a cast end-piece, which must be soldered or brazed to the blade;
- **Magnetic-loop contact fingers** to transfer current at both the contact and hinge ends of the switch—current-resisting hinge pins, springs and braids are eliminated;
- **Rotating rear insulator** with long-life tapered bearings to permit maximum force to be delivered to blade for superior ice-breaking action.

Why settle for less? For more information, contact your General Electric Sales Engineer. Or write to Section 495-08, General Electric Co., Schenectady 5, N. Y.

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GENERAL ELECTRIC

ICE TESTS, life tests, electrical tests, provide proof that General Electric RF-2 disconnect switches meet or surpass all rated duty requirements.

'Dynomogram' Helps Find Wire Tension

PHILIP C. EVANS, International Power and Engineering Consultants, Ltd, Vancouver, B. C.

Timing the travel of an applied mechanical wave helps determine quickly and simply the tension in an overhead wire. For this purpose a conventional dynamometer has certain disadvantages—it is cumbersome, delicate in adjustment, and not always easy to attach to the wire.

The "Sagwatch" (EW, Dec 22, 1958, page 82) uses timing to measure sag in wires of various sizes over various spans. As sag is a direct and unique function of the time of wave transit, this permits sag to be read directly without computation or reference to tables or curves. From the sag we can obtain the tension by using the relationship:

$$P = \frac{wa^2}{8D} \qquad (1)$$

where P = tension, lb
w = unit weight of wire, lb/ft
a = span, ft
D = sag, ft

This formula will give the result, but the need for a field calculation after reading the watch nullifies the advantages of the Sagwatch, simplicity and ease of use.

This suggests the possibility of a direct-reading "tension watch." From basic principles we have the relationships:

$$v = \sqrt{\frac{Pg}{w}} \qquad (2)$$

and

$$t = \frac{a}{v} \qquad (3)$$

where v = wave velocity, ft/sec
g = acceleration of gravity, or 32.2 ft/sec²
t = time for wave to travel one span, sec

Combining (2) and (3) gives

$$P = \frac{wa^2}{gt^2} \qquad (4)$$

Tension, unlike sag, is not a unique function of the time of wave travel, but depends on the weight of wire and length of span. This complicates the proposed design, because three independent variables must be considered, rather than one.

Furthermore, t represents the time for wave travel of only one span. A round trip of the wave, and preferably more than one, must be timed for precision. The number of round trips that can be counted will vary with conditions and depends on the weight of wire and span length. For flexibility and range, another variable should be introduced:

Let n = number of wave returns to be counted and T_n = time for n returns of the wave

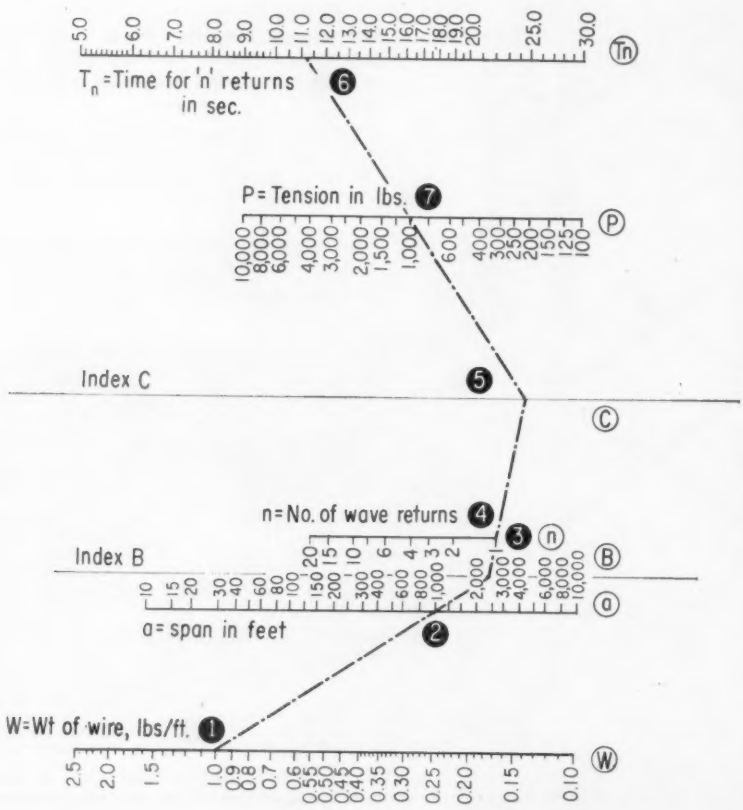
Then $$T_n = 2nt \qquad (5)$$

and substitute in (4) to get

$$P = \frac{wa^2n^2}{8.05T_n^2} \qquad (6)$$

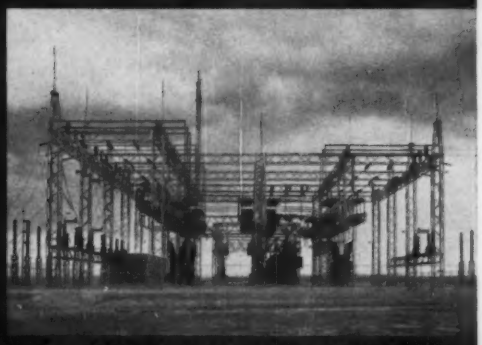
It is feasible to design an instrument to be entered with these quantities that would give a direct reading of tension, but such an instrument would be too complex and expensive for field use. Search for a compromise has led to the accompanying "Dynomogram." Used with an ordinary stopwatch, it gives a quick and easy solution of formula (6).

The nomograph covers a range of wire weights from 0.1 to 2.5 lb/ft and span lengths from 10 to 10,000 ft. The time scale covers 30 sec, representing one revolution on a 0.1-sec stopwatch. The number of wave returns to be counted ranges from 1 to 20. Tensions from 100 to 10,000 lb can be determined.

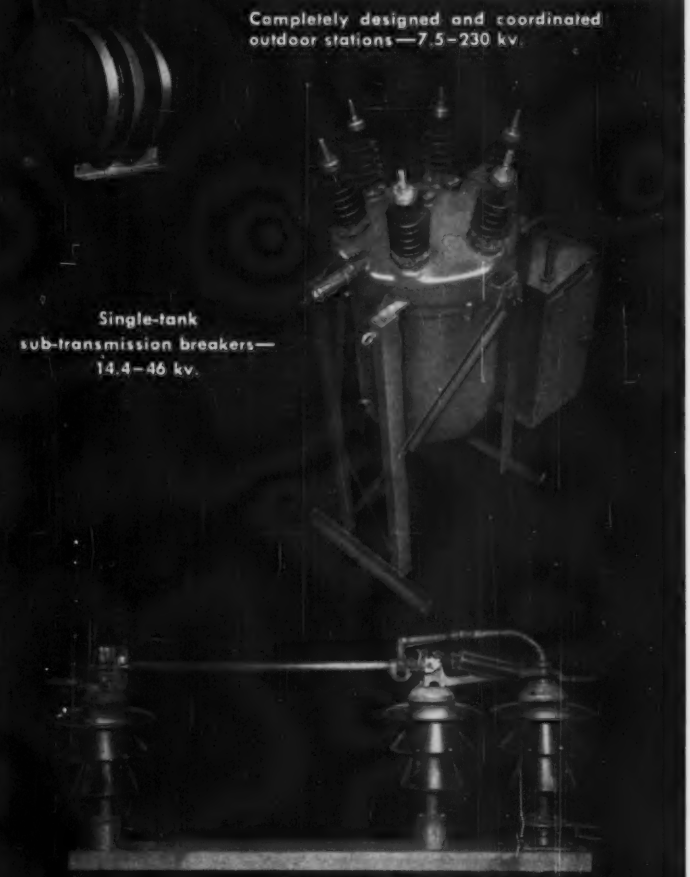


DYNOMOGRAM solves formula (6) in test above. Mark unit weight of wire on Scale W as at **1**. On Scale a mark the span in ft as at **2**. Connect **1** and **2** and extend to meet Index B as at **3**. Vibrate the wire by striking near one support and note maximum number of wave returns that can be clearly seen or felt. Mark this number on Scale n as at **4**. Connect **3** and **4** and extend to meet Index C as at **5**. Measure the time for n returns. Mark this number on Scale T_n as at **6**. Connect **5** and **6** and read tension on Scale P as at **7**

Single column of Type ATB air-blast power circuit breakers—115–460 kv.

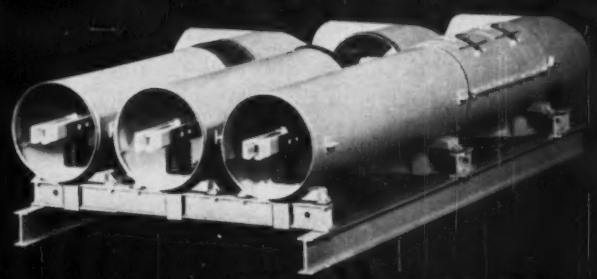


Completely designed and coordinated outdoor stations—7.5–230 kv.



Single-tank sub-transmission breakers—14.4–46 kv.

Disconnect switches—7.5–345 kv.



Isolated phase bus—14.4–34.5 kv, through 20,000 amps.

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Why Settle for Less?

When you buy General Electric generation and transmission switchgear, you get one all-important benefit no other manufacturer can match—*outstanding added value.*

You Get Top Product Design—From giant 460-kv air-blast breakers to custom-tailored outdoor stations, General Electric high-voltage switchgear equipment is designed for easiest installation, top safety, optimum performance, and dollar-saving ease of maintenance.

You Get Results of Research—Important General Electric developments in the high-voltage switchgear field include:

- First single-tank, five-cycle outdoor sub-transmission breaker;
- First modern air-blast transmission breaker;
- First isolated-phase bus with conductors having a 105°C maximum hot-spot temperature.
- First computer-designed outdoor station.

You Get Nation-wide Service—G-E sales offices and service centers throughout the nation assure you of prompt, courteous application and installation assistance; also, fast, high-quality maintenance and repair service.

Why Settle for Less? Whether you want one disconnect switch, or a complete, custom-tailored switching station, with General Electric you get the *best* in switchgear. For information on specific equipments, contact your G-E sales engineer. Or send in the coupon below.

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General Electric Co.
Section F492-13
Schenectady 5, N. Y.

Send me detailed information on the following:

- ☐ High-voltage air-blast breakers
- ☐ Disconnect switches
- ☐ One-tank sub-transmission breakers
- ☐ Isolated phase bus
- ☐ Outdoor stations 7.5 to 345 kv

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Procurement & Products

PRICES ▶ **In keeping with its pricing policy** of keeping published prices in line with market-generated prices, General Electric Co's medium transformer dept reduced lists by 4% on units 2000 through 7500 kva—following a 5% reduction made a month earlier.

One view on the market situation came from Tennessee Valley Authority Chairman Herbert Vogel who asserted "Competition has been stimulated among domestic equipment manufacturers by our turning to a foreign market and resisting collusive bidding."

BUYING ▶ **Criticism was leveled at the buying policies** of the Franklin County (Wash.) Public Utility District by Washington State auditor. State Auditor Cliff Yelle said records showed that the PUD placed 70 orders for approximately 270 transformers for a total of $77,827 and in each case the order was for less than $5,000. State law requires competitive bidding on all purchases amounting to more than $5,000, except in emergency situations.

RECIPROCITY ▶ **Sales executives were warned that reciprocity understandings** (you buy from us and we'll buy from you) are drawing some resentment from purchasing men who feel that such understandings "usurp their authority," and negate the importance of their standard criteria for picking suppliers. The warning was carried in an issue of Sales Management.

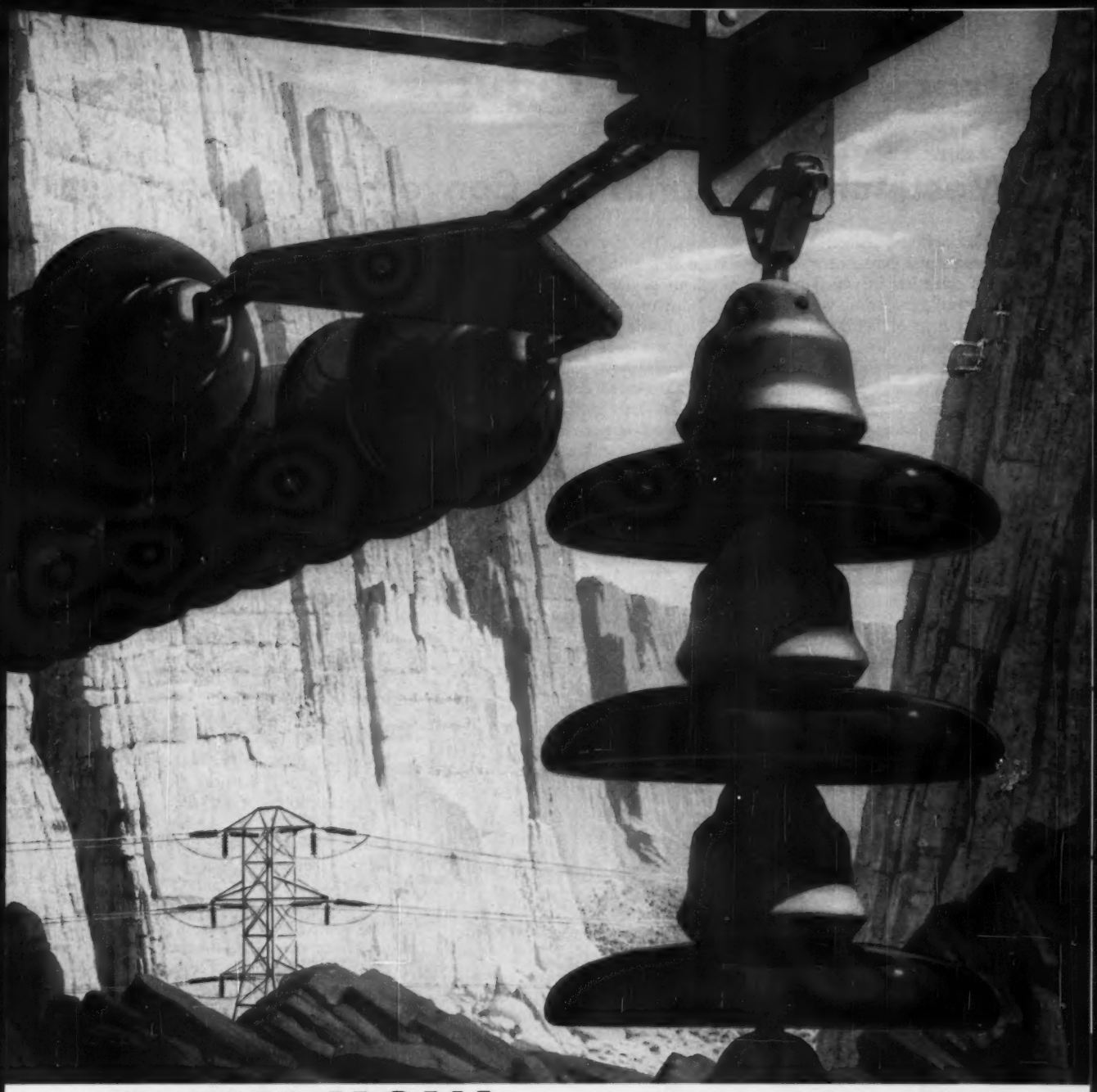
STANDARDS ▶ **American Standards Association issues new code,** bringing up to date the requirements and specifications of belts, anchors, and other safety equipment used by window cleaners in commercial buildings.

Two standardization projects in materials handling area are underway by ASA. These deal with pallets and freight containers and are viewed by shipping authorities as essential to the advancement of improved cargo handling techniques. Such standardization work may also be advantageous to utility storekeepers.

HANDLING ▶ **How to figure the relative costs of owning and operating** various types of industrial trucks is detailed in a series of booklets just put out by the Exide Industrial Division of the Electric Storage Battery Co. Factual industrial truck cost histories and do-it-yourself formulas for quick calculations and comparison of all expenditures are provided.

By applying your own figures to the do-it-yourself formulas, comparative costs for electrical, gasoline or propane power can be highlighted, and cash-draining hidden expenses in day-to-day truck operation revealed. Copies of the four booklets in the industrial truck cost series are available without charge from Exide, Rising Sun and Adams Avenues, Philadelphia 20, Pa.

MANUFACTURING ▶ **G & W Electric Specialty Co acquires 23-ton Wiedmann turret press** which permits punching operations to be carefully programed in advance. G & W says production rate and quality are thereby enhanced.



KNOW-HOW

Victor 900 Suspension Insulators (EEI-NEMA, TDJ52-3) are universally used by utility men because they're rugged and built to last.

Looking at a VICTOR Suspension insulator, you'd think it was an easy item to manufacture. It isn't. You don't just stamp them out like cookies, bake them in an oven and presto—insulators. No, a lot of research, engineering and manufacturing know-how over a long period of years is required to produce insulators that have uniform performance characteristics and far exceed EEI-NEMA standards.

VICTOR has an enviable reputation for knowing how to make insulators that are superior in performance under the most gruelling conditions of service. Many a power man has decided to play safe . . . and choose VICTOR. For catalog, specifications and prices, contact your nearby Victor sales office. Victor Insulators Division, I-T-E Circuit Breaker Company, Victor, N. Y.

I-T-E CIRCUIT BREAKER COMPANY

Westinghouse Combines Converters in Reactor

Westinghouse Electric labels as successful the experiment conducted by its scientists in which two forms of power generation were used to convert heat of fission inside a nuclear reactor directly into electricity. A thermionic and thermoelectric generator was built into a nuclear fuel assembly and inserted into a test reactor at Waltz Mill.

"The test unit," says John W. Simpson, vice president-general manager of the atomic power division, "produced less than one watt of power, but its operation opened the door to some exciting possibilities. The experiment was not made to determine optimum efficiency or high power output, only the feasibility of such a dual generator. Westinghouse plans to continue developing the fuel conversion system to increase its efficiency.

Continued development based on these tests may mean, Simpson pointed out, that nuclear powered generating stations of the future may have three operational stages—thermionic elements to convert the high temperatures in a reactor into electricity; thermoelectric elements to utilize the more moderate temperatures; and conventional generating equipment for lower temperatures.

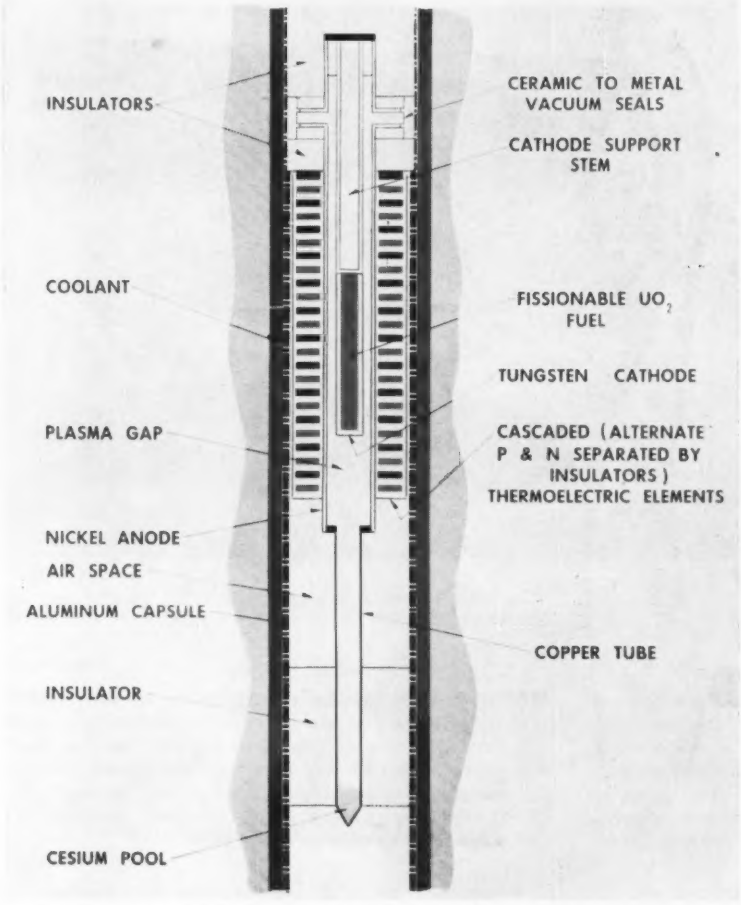
"This dual generator has been a goal throughout the industry for some time," Simpson commented. "This successful experiment adds another concept that can be considered in selecting power sources for special applications. Each particular system will have to be evaluated for its own requirements in weight, efficiency, cost, external environment and temperature."

The new concept, he said, will allow use of the high temperatures generated in nuclear reactors. While some fuel elements themselves reach temperatures above 4,000F in the fission process, he explained, nuclear scientists can get only about 600F out of the fuel elements and into the surrounding water. The high temperature advantage is lost because of the temperature drop from the center of the fuel elements to the outside surfaces in contact with the cooling water.

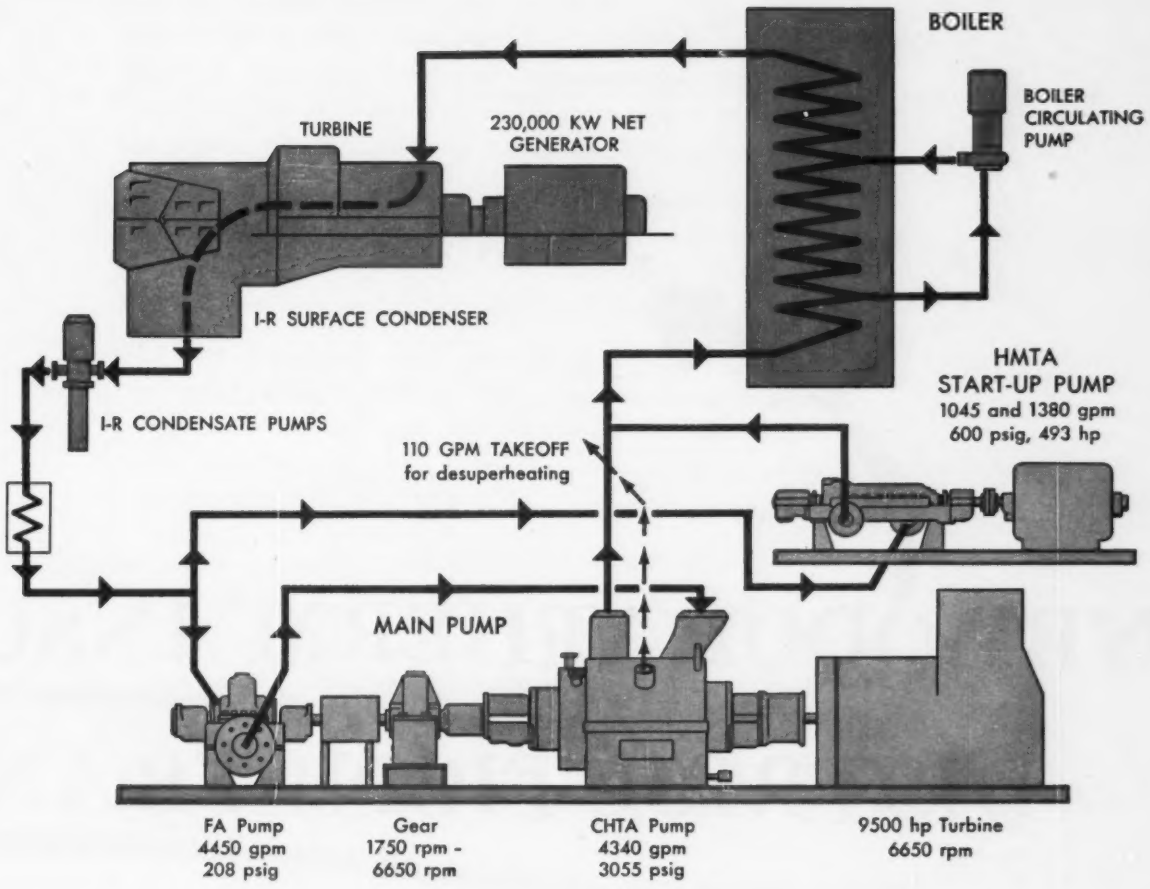
To capture this energy at its source, Westinghouse built a fuel element with the thermionic generator at its center and a thermoelectric generator surrounding it. The scientists in charge of the tests took into consideration these facts: that both methods of converting heat directly to electricity operate on similar principles, but at widely divergent temperatures. A thermionic generator operates at incandescence, about 3,500F, but will not function efficiently at temperatures below 2,700F. On the other hand, a thermoelectric unit does not operate at such elevated temperatures, but works efficiently at between 600-1,300F.

However, by putting the two types of generators in tandem, Westinghouse found that heat passing through the thermionic generator flowed through the thermoelectric unit. The elements were wired in series to give a combined electrical output in a wide temperature range.

(*More News of Manufacturers, p* 64)



THERMOELECTRIC-THERMIONIC DIRECT CONVERTER used in Westinghouse test reactor at Waltz Mill established feasibility of new concept



Ingersoll-Rand FULL CAPACITY boiler-feed pump

for Unit No. 2 at MECO's Portland Station

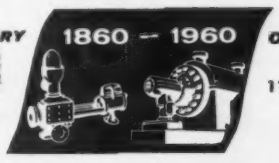
UNIT No. 2 at Metropolitan Edison Company's Portland Station, being designed by Gilbert Associates, Inc., will be served by the Ingersoll-Rand boiler-feed pumps shown in the diagram. Three pumps are involved —one for start-up and two in series for main boiler feed-service. The main pump, a high-speed unit, is rated at full boiler capacity and will operate *without a spare.*

The main pumping unit consists of a low-pressure Type FA horizontally-split pump feeding the high-pressure barrel-type CHTA pump, both units being tandem-driven by a 9500-hp steam turbine. The FA takes feedwater at 108 psig, discharging at 208 psig to the CHTA, which discharges to the boiler at 3055 psig. The electrically driven startup pump is arranged to cut out after the main pump has attained full speed.

Other Ingersoll-Rand pumps that will be installed in MECO's Portland station expansion include condensate and circulating pumps, boiler-circulating pumps, and a variety of units for miscellaneous services. In addition, Ingersoll-Rand is also supplying the main condenser and its air removal equipment.

For specific details on pumps and other I-R equipment for any power plant application, call your Ingersoll-Rand engineer. His specialized experience can save you time and money.

A CENTURY Ingersoll-Rand



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NEW DURATHERM* INSU

DISTRIBUTION TRAN

INCREASED KVA CAPACITY

*Trade Mark

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Extremely long life, even at high overloads, may be obtained from Moloney Distribution Transformers incorporating Duratherm, a new high temperature insulation. Transformers incorporating Duratherm will be available in single-phase ratings 167 KVA and smaller, and in three-phase ratings 150 KVA and smaller.

Duratherm is an insulating paper which has been especially processed during manufacture to reduce the rate of deterioration when subjected to high temperatures. This insulation is completely compatible with the other material used in the transformers.

This new insulation permits operation of the transformers at considerably higher hottest-spot temperatures than was formerly possible with standard kraft paper insulation. This means even better performance for Moloney Distribution Transformers which are already noted for their high overload capacity and long life.

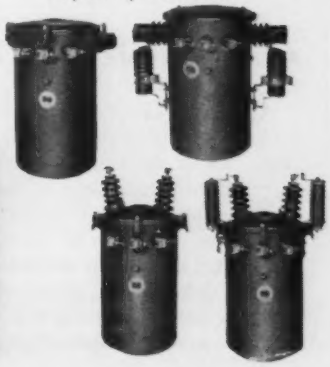
LATION FOR MOLONEY SFORMERS PROVIDES

The application of Duratherm insulation does not affect the basic design of the transformers. No change in losses, loss ratio or impedances is involved. Transformers with Duratherm will continue to have ASA Standard 55 C KVA ratings, but due to the high temperature insulation, will have an additional nameplate rating at 65 C average temperature rise. This additional rating will be 12% higher than the 55 C rating.

The cooling capacity of Duratherm-insulated Distribution Transformers will not be changed. Because of this, even when operating at the much higher overloads possible with these transformers, oil temperature will not be such that special high temperature oil will be required.

ME60-21

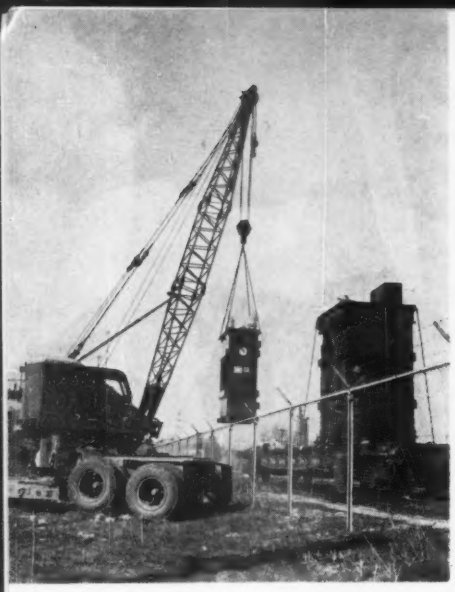
The increased KVA capacity and longer operating life resulting from the use of Duratherm insulation are but two of the many advantages to be obtained by using Moloney Distribution Transformers. Ask your Moloney representative for additional information on Duratherm and the other features of Moloney transformers which result in superior performance.



MOLONEY ELECTRIC CO.

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

MISSOURI, AND TORONTO, ONT., CANADA



Hubbard-Kearney Lab Adds Equipment

Hubbard & Co, Chicago, and James R. Kearney Corp, St. Louis, have installed four new transformers at the Hubbard-Kearney Electrical Research Laboratory at McCook, Ill, to enable development of new electrical apparatus and pole line hardware equipment.

Largest of the new equipment is Hubbard's 26-ton transformer (right in photo) which will produce momentary currents up to 300,000 amp for testing thermal and mechanical effects of extremely high short-circuit currents on switches and other apparatus. Power generated by the unit would explosively disintegrate No. 2 solid copper or melt a 2-in.-dia copper conductor in four sec.

The 12-ton, low-impedance autotransformer being hoisted off flat car (left in photo) will be used for short-circuit testing of both Hubbard and Kearney equipment at voltages from 18 to 36 kv.

A heat-run transformer providing continuous currents up to 40,000 amp for testing thermal capacity of any current-carrying apparatus, also a series-regulating transformer which provides voltage regulation as low as ⅓% on the companies' lab bus are the other additions.

Zinc-Oxygen Fuel Cell Developed

Electric Storage Battery Co announces that development of its zinc-oxygen fuel cell has reached the stage that first commercial application as a packaged power unit is in view. Arrangements have been made with 17 manufacturers of materials handling equipment to help ESB develop the cell for in-plant industrial trucks. After the fuel cell has been tested in rugged, long-shift lifting and hauling, it might be adapted for automobiles and street trucks, says ESB. Development is in the hands of ESB's Exide Industrial Division.

The exhausted cell can be recharged electrically by reversing the oxidation process. The discharged zinc electrode can be removed and charged outside the cell, or it can be quickly replaced. In the latter case, the zinc oxide of the discharged zinc electrode is valuable recoverable material.

The equipment area under investigation includes fork lift trucks and other types of electric materials handling equipment. The ESB zinc-oxide fuel cell employs zinc instead of gaseous fuel, such as hydrogen, which ESB believes is a "radical departure" from other fuel cells. The electric current is obtained when oxygen, admitted under low pressure, oxidizes a zinc electrode in a potassium hydroxide electrolyte.

From knowledge gained in the ESB laboratory, it would appear this fuel cell now being studied by the 17 manufacturers will provide enough power to keep an electric industrial factory truck going continuously for 16 to 24 hr of heavy-duty service before recharging.

The cell features operation at nearly normal temperatures and pressures, lack of waste products, ability to be scaled up or down in size, and electrical capacity to permit a wide range of power requirements. It lends itself to mass production techniques.

Development of the cell was conducted in ESB and Exide labs.

Alcoa Develops New Group of Aluminum Alloys

Aluminum Co of America has developed a new group of aluminum alloys which, the company says, display amazing resistance to the corrosive attack of high temperature steam and water. The aluminum-iron-nickel alloys can withstand the sharply deteriorating effect of high purity water at up to nearly 700F.

The new compositions hold promise, says Alcoa, as cladding for uranium fuel rods in the more powerful atomic reactors being designed. In these reactors the cooling medium is heated to nearly three times the 250F reached in present units. Commercial aluminum alloys now used are limited to containing steam and high purity water in temperature zones up to 450F.

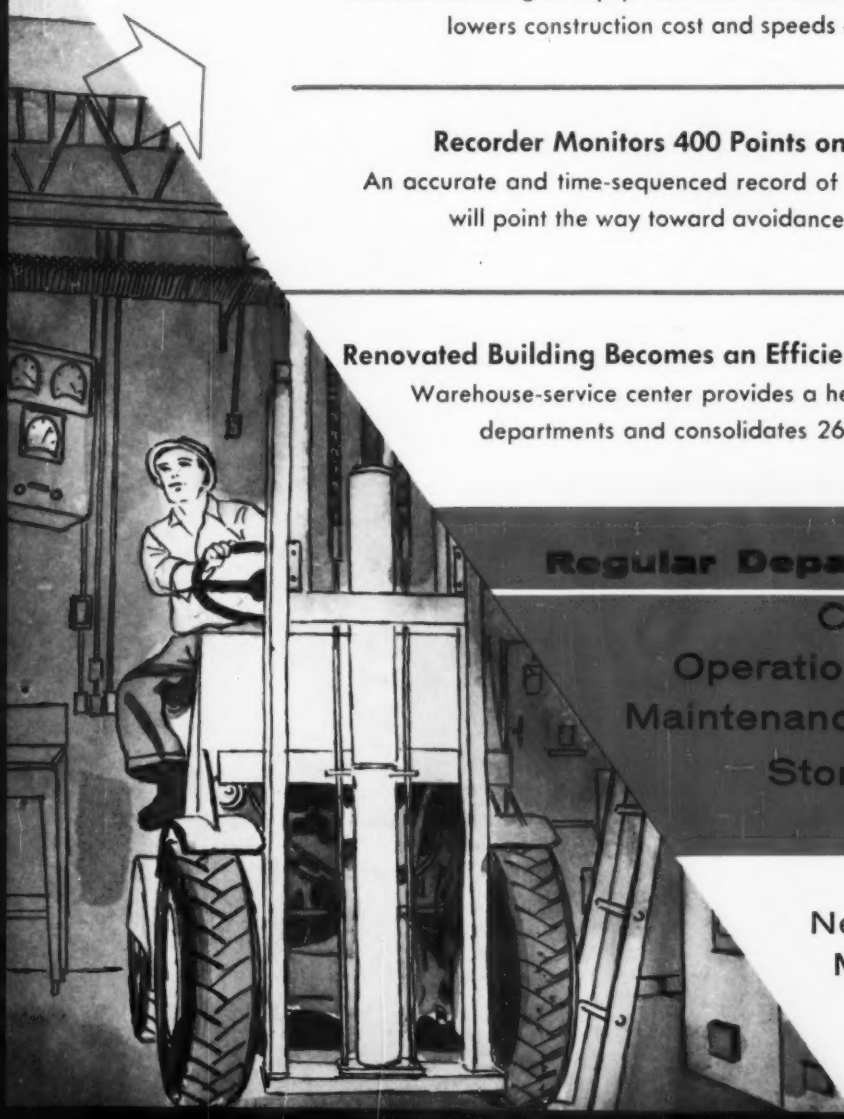
The new Alcoa alloys were tested in both wrought and APM (aluminum powder metallurgy) forms. An APM alloy, containing 4.81% iron and 7.03% nickel, recorded the most spectacular results. Of all alloys evaluated at 680F, the APM composition registered least susceptibility to corrosion. Initial corrosion rate diminished quickly.

Electrical World Report

MAY
JUNE
1960

ELECTRIC utility methods

CONSTRUCTION • OPERATION • MAINTENANCE



Fork Lift Speeds Installation of Substation
Efficient handling of equipment and materials with a fork-lift truck lowers construction cost and speeds completion of the job — p 82

Recorder Monitors 400 Points on Three Main Units
An accurate and time-sequenced record of abnormal operations will point the way toward avoidance of future shut-downs — p 84

Renovated Building Becomes an Efficient Operating Base
Warehouse-service center provides a headquarters for many departments and consolidates 26 older service centers — p 86

Regular Departments

Construction — p 88
Operation & Testing — p 96
Maintenance & Repair — p 102
Stores & Shops — p 110
Safety — p 114

New Equipment — p 67
Manufacturers Literature — p 118

Now... FARGO POWER CONNECTORS

Fargo "P Series" Power Connectors Feature

1. Wide range including both tube and cable sizes in each clamp to reduce inventory.

2. Extra long contact areas and complete encirclement of all cables in a given range assures maximum contact and low resistance joints.

3. Even the finest strands are confined in the clamping area providing optimum performance.

4. Direct current interchange between top and bottom members removes high resistance bolts as interchange medium.

5. Three piece tee and straight connectors permits independent clamping on each conductor.

6. Hex head ½" bolts threaded directly into body provides for one wrench installation.

7. Inverted mounting of lugs allows easy hot stick installation on switches.

8. Available for both copper and aluminum connections.

Ask your Line Material Field Engineer for complete details.

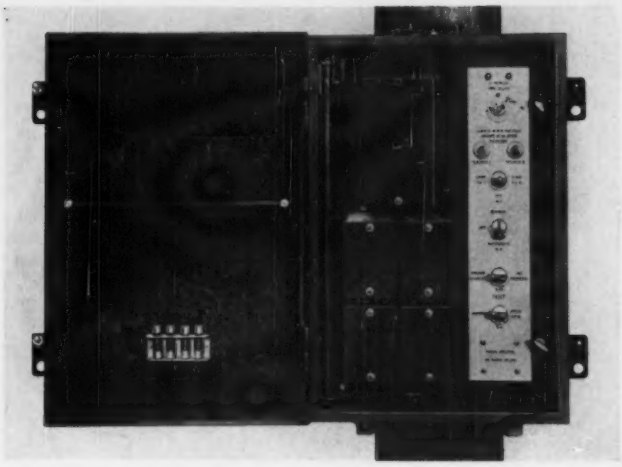
Patented

Distributed by
LINE MATERIAL INDUSTRIES
McGraw-Edison Company
Milwaukee, Wisconsin
In Canada, CLM INDUSTRIES, Toronto 13, Canada

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

NEW EQUIPMENT

To obtain more information on these items, use code numbers indicated for each item when filling in Readers Service Card



Control Unit . . .

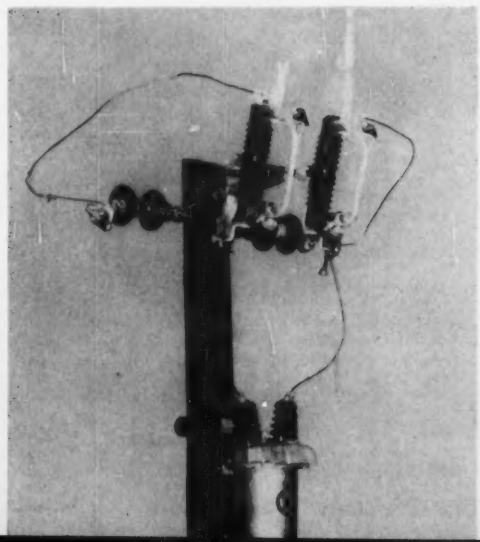
. . . transfers a distribution line automatically to a second source if any phase of the connected source fails. The type S load transfer control offers a selection of operating sequences and two ranges of time delay, 2-57 sec and 10-235 sec. A hinged panel permits ready access to internal wiring. It is intended to control a recloser, circuit breaker or similar switch.

Line Material Industries, Milwaukee 1, Wis. (1)

Schering Bridge . . .

. . . for test voltages to 465 kv measures power factors and capacitances of full reels or of short samples of cables, including 3-conductor belted cables. The bridge measures power factors as high as 21.11% and capacitances to 2.0 μf at charging currents as high as 10 amp. Limiting factor in its application is the current in the cable being measured.

Leeds & Northrup Co, 4901 Stenton Ave, Philadelphia 44, Pa. (2)

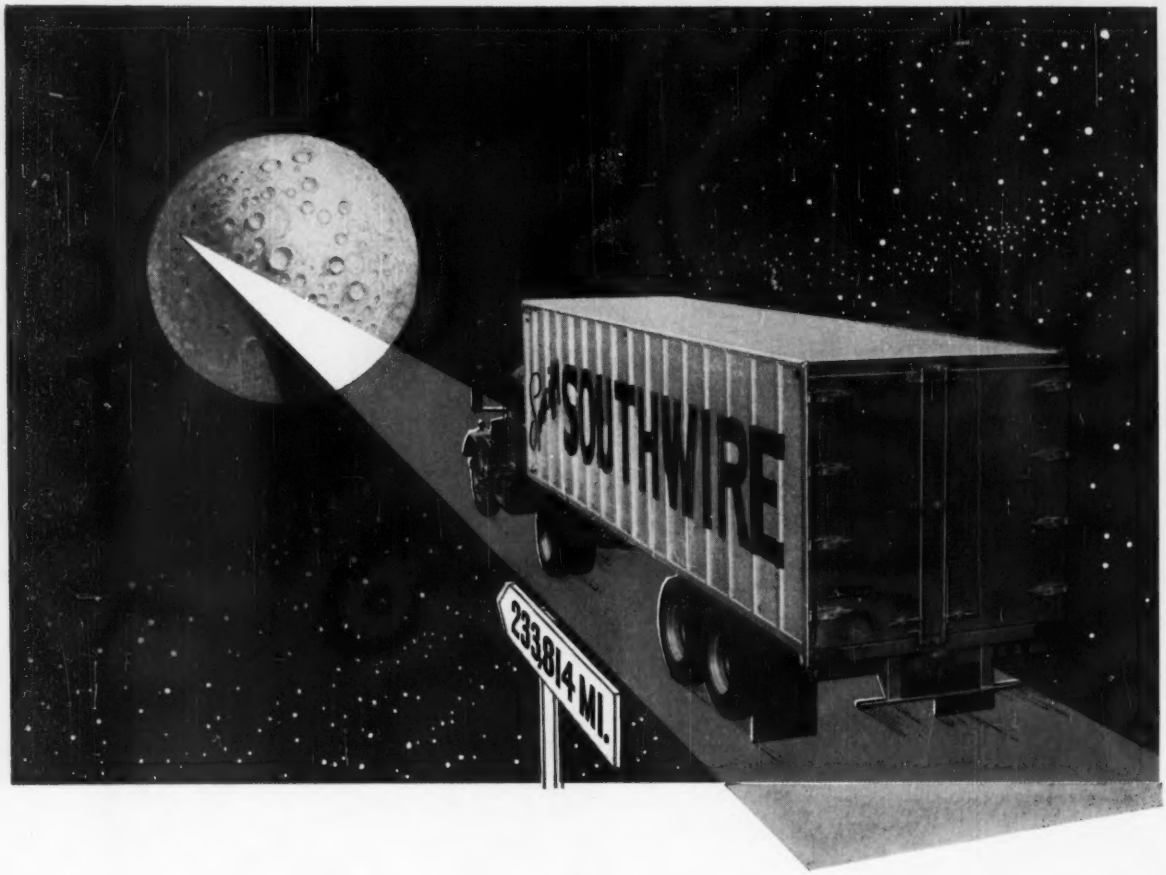


Bypass Switch . . .

. . . for 15 kv and 200 amp continuous current has a BIL rating of 95 kv. The device permits bypassing a distribution recloser or regulator for maintenance work. Operation is by hot-line stick. When the recloser or regulator is out of service for an extended time, a fuse put in place of one cutout's disconnect blade protects the line; a jumper across the bottoms of the cutouts completes the circuit, with the bypass switch open.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa. (3)

(More New Equipment on page 69)



We shoot for the moon every month!

The mean distance from the surface of the earth to the surface of the moon is 233,814 miles. Every month Southwire trucks come close to registering that many miles right here on good old terra firma. Our record so far was set at 229,893 miles in December 1959.

Like some others who are shooting for the moon, we haven't made it yet, but that doesn't keep us from trying. Someday soon we'll do it, and then we'll try for the round trip—467,628 miles!

Far-fetched? We think not. It points up Southwire's unwavering aim to produce more and better wire, and better service.

How does anyone reach the moon unless he shoots for it?

Southwire Company

SOUTHWIRE serves the world

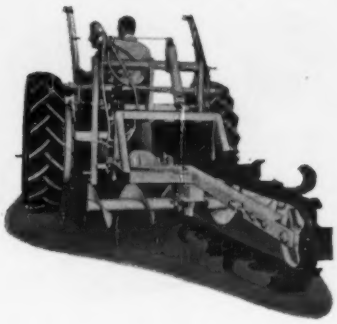
Carrollton, Georgia — TErrace 2-6311

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP* (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- NM Sheathed Cable
- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

Herbicide Spreader...

. . . applies dry granular weed killer over a 6-ft swath by turn of the crank. The PCB spreader, which is strapped to the operator's shoulder, weighs 6 lb. One 25-lb filling of Ureabor weed killer treats 2,500 sq ft of ground. No liquid has to be added.

United States Borax & Chemical Corp, 630 Shatto Pl, Los Angeles 5, Calif. (4)



Ditcher . . .

. . . fits any 3-point tractor hitch. The 3P Pow-R-Ditcher digs a 4½-ft-deep trench 6 to 16 in. wide. The tractor's hydraulic system delivers the power; a double-disc friction-slip clutch provides digging safety. One lever controls the speed through a rachet device.

Vermeer Mfg Co, Pella, Iowa (5)

Mobile Tester . . .

. . . checks circuit breakers of 75,000 amp interrupting capacity. Model CB-750 has an output of 7,500 amp at 0-10 v on a basis of 30 min on and 30 min off. Overload capacity is 500% for 0.6 sec. Metering and timing equipment and motor-driven voltage control are built in.

Multi-Amp Electronic Corp, Box 217, Union, N. J. (6)

Storage Rack . . .

. . . is assembled without tools. Punched 3x3-in. columns permit the user to install load-supporting beams at his choice of heights; the keyhole slots are on 2-in. centers. Standard Aim slotted angle structure supports 23,000 lb and heavy-duty frame, 30,000 lb.

Acme Steel Co, 135th St & Perry Ave, Chicago 27, Ill. (7)

(More New Equipment on page 70)

KLEINS

for LINEMEN and ELECTRICIANS

The Original Klein Side Cutting Plier—Also available in NE (Streamlined) type. Cat. No. 201

High Leverage Plier—Extra high leverage permits cutting extremely tough wire. Also available in the standard type as shown above. Cat. No. 213-9NE

High Leverage Oblique Cutting Plier—A recently introduced plier designed to cut toughest wire. Cat. No. 228-8

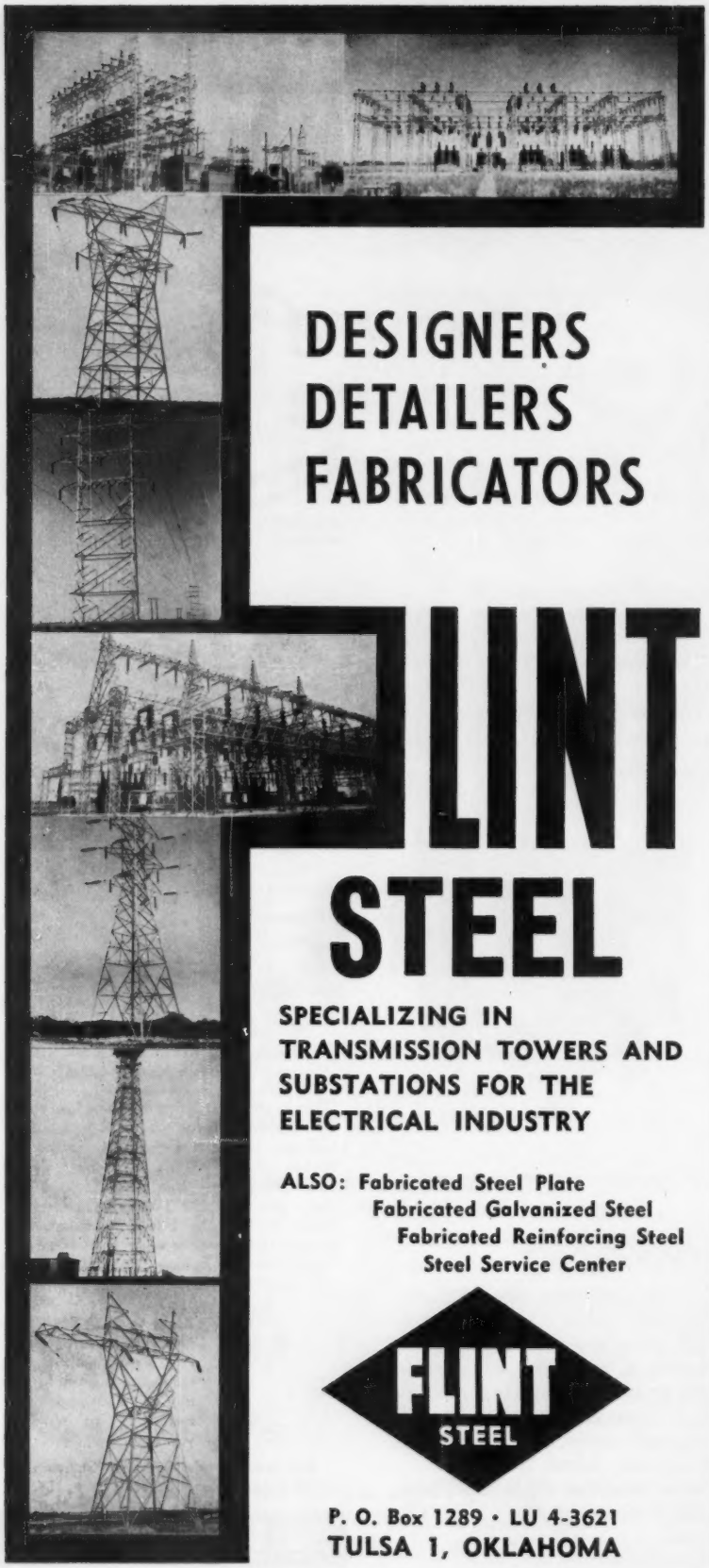
Electrician Conduit Plier—Reams inside and outside of conduit, tightens lock nuts in outlet boxes. Cat. No. 333-8

"Since 1857" the name Klein has stood for the finest in tools and equipment for linemen and electricians. It is the uncompromising high quality back of the name Klein that has won Klein Pliers their place in the hands of men who know good tools. Klein Pliers are now available in a wider variety of styles and sizes than ever before. Be sure the pliers you need carry the Klein trade-mark.

Klein Catalog Free—This new Klein catalog giving complete information on Klein tools and equipment for linemen and electricians will be sent on request. Write for your copy.

Ask Your Supplier—Foreign Distributor: International Standard Electric Corp., N.Y.

Mathias KLEIN & Sons
Established 1857 — Chicago, U.S.A.
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS



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STEEL

SPECIALIZING IN
TRANSMISSION TOWERS AND
SUBSTATIONS FOR THE
ELECTRICAL INDUSTRY

ALSO: Fabricated Steel Plate
Fabricated Galvanized Steel
Fabricated Reinforcing Steel
Steel Service Center

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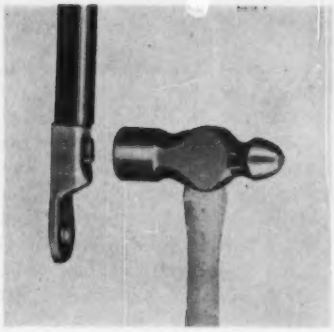
P. O. Box 1289 · LU 4-3621
TULSA 1, OKLAHOMA

Connectors . . .

. . . need only a hammer for attaching to conductors. Available for wire sizes No. 6-1 and No. 1/0-4/0, "RED-E" lugs and splicers have cable size and stripping gauge markings stamped into them. User strikes a built-in impact punch with a hammer to set the connector on the wire. **Bernard Welding Equipment Co, 10232 Ave N, Chicago, Ill (8)**

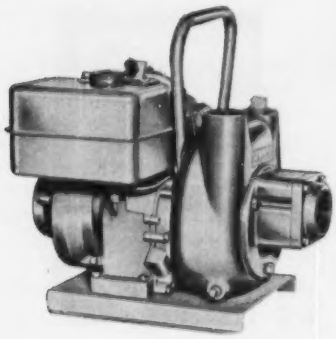
Utility Pump . . .

. . . can be carried by one man. Self-priming M-7 discharges 7,000 gal per hr; M-5 pumps 5,000 gal per hr. Engine is aluminum. Non-clogging impeller, which can be replaced without removing the pump case, handles water that contains a high percentage of solids.
F. E. Myers & Bro. Co., Ashland, Ohio (10)



Emergency Lamp . . .

. . . is battery powered. Charging of the DR402T 6-v nickel-cadmium battery is controlled automatically by transistorized circuits, which operate without switches or dials. Full charge is reached in 12 hours.
Electro Powerpacs, Inc, Cambridge, Mass. (9)



Ladder Brace . . .

. . . permits a good working position by holding the ladder away from the wall. The Sky Hook's 3-ft-long bearing board has a non-skid surface; the board can be adjusted to any roof slope. Rustproof heavy-duty steel tubing serves as safety rails.
Clayton Mark & Co, 1900 Dempster St, Evanston, Ill. (11)

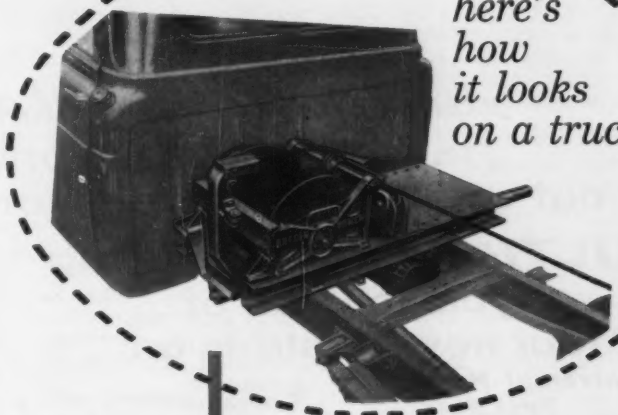
(More New Equipment on page 72)

a winch so unusual

we don't know how many uses it has!

here's how it looks inside

here's how it looks on a truck



BRADEN CL WINCH

This BRADEN CL Winch was designed primarily for utilities. It will draw wire or cable at a CONSTANT SPEED until the winch drum is completely filled! *This has not been possible before.*

We believe there are many uses for the new CL Winch. Maybe it will help solve a winching problem for you where CONSTANT SPEED is desirable. Write for complete information on this unusual CL Winch, or let us know if you would like for a representative to call on you. We believe we've really got something.

BRADEN WINCH DIVISION OF MOTOR PRODUCTS CORPORATION
P. O. BOX 547 • BROKEN ARROW, OKLAHOMA

"In Service Around the World"

CIRCLE 71 ON READER SERVICE CARD

Now Available

for OPERATING and TESTING ENGINEERS!

Select the test equipment that takes the guesswork out of electrical protection!

MULTI-AMP *Now* offering your choice of four new catalogs on:

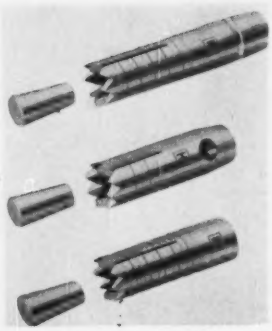
Universal Portable Test Sets

- **PROTECTIVE RELAYS**
  Catalog SB-RT-1
- **OIL CIRCUIT RECLOSERS**
  Catalog SB-OCR-1
  Standard Ratings 4, 7.5, 15Kva
- **CIRCUIT BREAKERS**
  Catalog SB-CB-1
  Standard Ratings 1, 2.5, 5, 7.5, 15, 22.5 Kva
- **UNIVERSAL PORTABLE LOAD BOXES**
  Catalog SB-LB-1
  Standard Ratings 0.1 through 5Kva

MULTI-AMP will be pleased to send you these four descriptive, colorful and well illustrated catalogs. Developed to help you select the proper test equipment for every application, these valuable catalogs offer over 80 pages of complete and detailed information on every advanced MULTI-AMP unit. They're easy to obtain, simply drop us a note on your company's letterhead. Your new MULTI-AMP catalogs will be on their way by return mail.

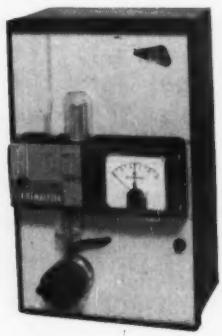
Write Today! Dept. EWB

MULTI-AMP Division
MULTI-AMP ELECTRONIC CORPORATION
465 Lehigh Avenue, Union, New Jersey



Aerial Lift . . .

. . . has 50-kv dielectric strength. Outer boom is of glass and epoxy. The Trim Lift is for tree trimming, street light maintenance and distribution line work. It is furnished with the quickly dumped Tilt Action truck body. **Asplundh Chipper Co, 501 York Rd, Jenkintown, Pa. (13)**



Fabrics . . .

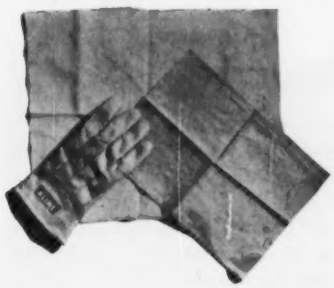
. . . impregnated with aluminum resist temperatures to 2,500 F. Treated fabrics retain their strength, texture and flexibility. They are useful for gloves, for heat-resistant curtains for industry and for wrapping pipes and conduits for keeping the heat in. **Baxter, Kelly & Faust, Inc, C and Tioga St, Philadelphia 34, Pa. (15)**

Anchors . . .

. . . for concrete, brick and stone surfaces are made of case-hardened steel and have cutting teeth so they can be used as their own drills. "Hi" self-drilling anchors support conduit, potheads and other hardware. Fourteen models are available for hand or power hammer installation.
Holub Industries, Inc, Sycamore, Ill. (12)

Chemicals Monitor . . .

. . . uses photoelectric comparison in colorimetric analysis for on-stream gauging of hardness in zeolite or base exchange softeners, residual chlorine in drinking potable water or excess phosphates in residual in boiler water. An indexing drive provides controlled reagent feed.
Milton Roy Co, 1300 E Mermaid Lane, Philadelphia 18, Pa. (14)



(More New Equipment on page 74)

FOUR PRINCIPLES FOR TRANSFORMER PAINTING

1. **Color.** There is a direct relationship between color and operating temperature. Subox paints are made in modern colors to meet *present-day peak load requirements.* They are available in standard grays, and also in decorator shades for color-styling in residential neighborhoods.
2. **Film Thickness.** When repeated coats of paint build up on a transformer they tend to act as a blanket and hold the heat in. With Subox paints, *fewer coats are needed* and internal heat is more efficiently dissipated.
3. **Long Life.** The paint on a transformer is subject to wide temperature changes. *All Subox paints contain suboxide of lead.* This unique pigment remains chemically active even after drying; builds a tough, fibrous film that maintains flexibility and does not crack, chip, peel or blister even under the most punishing conditions.
4. **Film Structure.** Aluminum-containing paints are often desired because they reflect sunlight; however, in conventional paints of this type the aluminum flakes overlap and leaf together to form an insulating barrier. In our Subalox paints, the polished aluminum flakes are non-leafing and do not overlap. Therefore, they promote both reflection and better radiation.

Leading electric utility companies use Subox paints for transformers. Write for color card and literature.

SUBOX PAINTS

Subox Inc.
Trade Mark

Established 1924
3 Fairmount Plant, Hackensack, N. J.
Subox Company of Canada, Weston, Toronto 15

SAFETY by-the-MILE

with CF&I Galvanized Steel Strand

CF&I Galvanized Steel Strand used as overhead ground wire safeguards your power cables all along the line. It takes the punishment from lightning and shunts it harmlessly aside.

This kind of safety is inherent in every foot of CF&I Galvanized Steel Strand. The wire is expertly drawn from selected steels. After the wire is hot-dipped in zinc for extra weather resistance, it is stranded. The quality controls used in each manufacturing operation assure a strong, safe, dependable grounding wire.

For standard applications, CF&I Galvanized Steel Strand is made to ASTM specification A-363 in seven- and three-wire constructions. For special applications CF&I is equipped to manufacture strand to your own specifications.

For complete details and delivery schedules, contact your local electrical distributor.

7702

CF&I STEEL

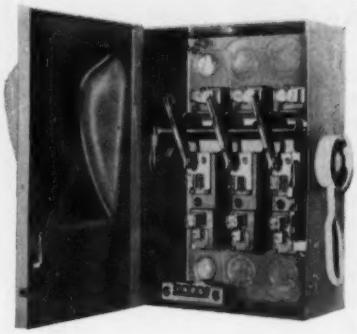
GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

In the West: THE COLORADO FUEL AND IRON CORPORATION — Albuquerque • Amarillo • Billings • Boise Butte • Denver • El Paso • Farmington (N. M.) • Ft. Worth • Houston • Kansas City • Lincoln • Los Angeles Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro Seattle • Spokane • Wichita

In the East: WICKWIRE SPENCER STEEL DIVISION — Atlanta • Boston • Buffalo • Chicago • Detroit New Orleans • New York • Philadelphia

CF&I OFFICE IN CANADA: Montreal

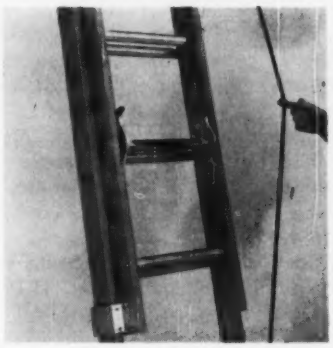
CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg



Lifting Trucks . . .

. . . are battery powered. The line of 24 trucks includes units capable of handling 2,000-lb loads of 24-in. lengths and trucks with capacities of 1,500 lb and 32 in. Frames are of all-welded steel, lifting channels of alloyed steel.

American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa. (17)



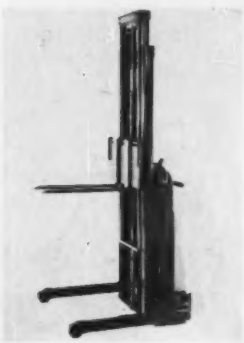
Recorder . . .

. . . for panel installation has a swing-out carriage and a slide-out chassis for easy access. The "recti/riter" strip-chart recorder, which has an illuminated scale, is furnished in single and dual-channel models.

Texas Instruments Inc, 3609 Buffalo Swy., Houston, Tex. (19)

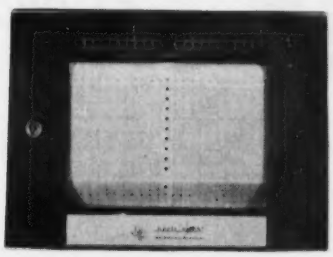
Safety Switch . . .

. . . has a yellow handle which can be seen readily, even in poor light. Type ND switch's snap-action make and break and its double-blade construction hold down pitting and burning. Ratings are 250 and 600 v, and 30 and 60 amp.
Clark Controller Co, 1146 E 152nd St, Cleveland, Ohio (16)

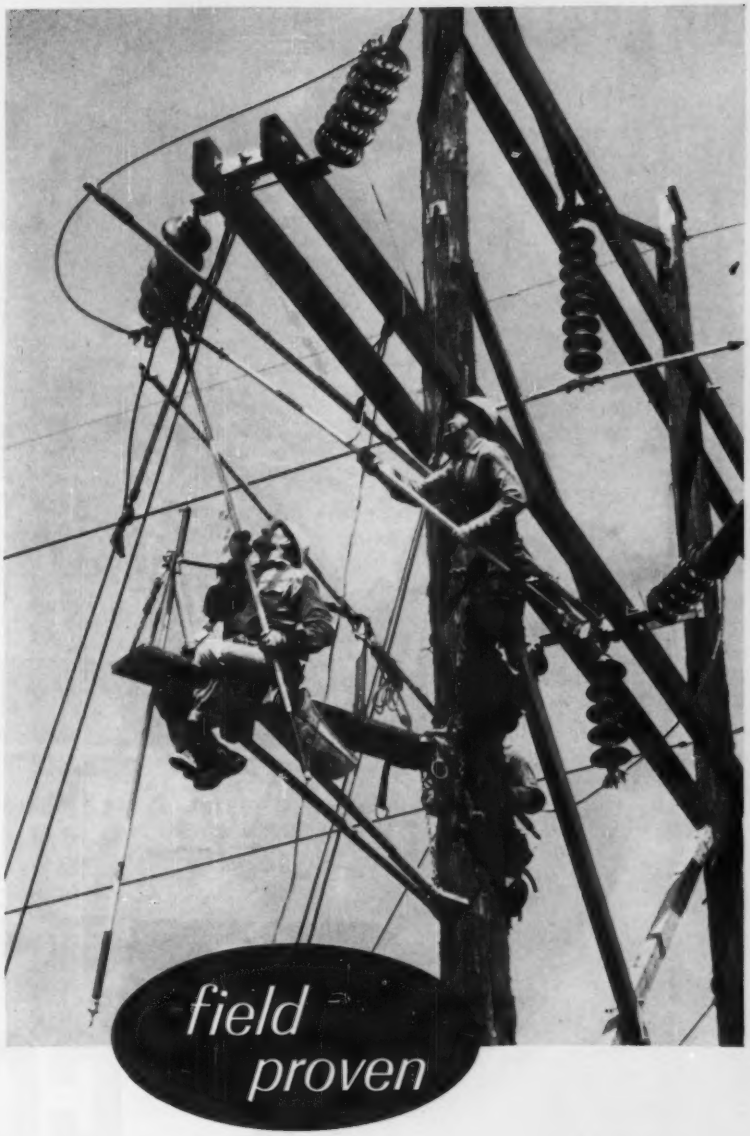


Ladder . . .

. . . has non-conductive rails made of fiberglass-plastic channels bonded around prepared hardwood. They are impervious to water and paint, resist corrosion, do not scratch or splinter. Aluminum steps have carborundum non-skid strips. Adjustable base legs, called Equalizer, are an optional extra.
Hopfeld Industrial Mfg Co, San Rafael, Calif. (18)



(More New Equipment on page 78)



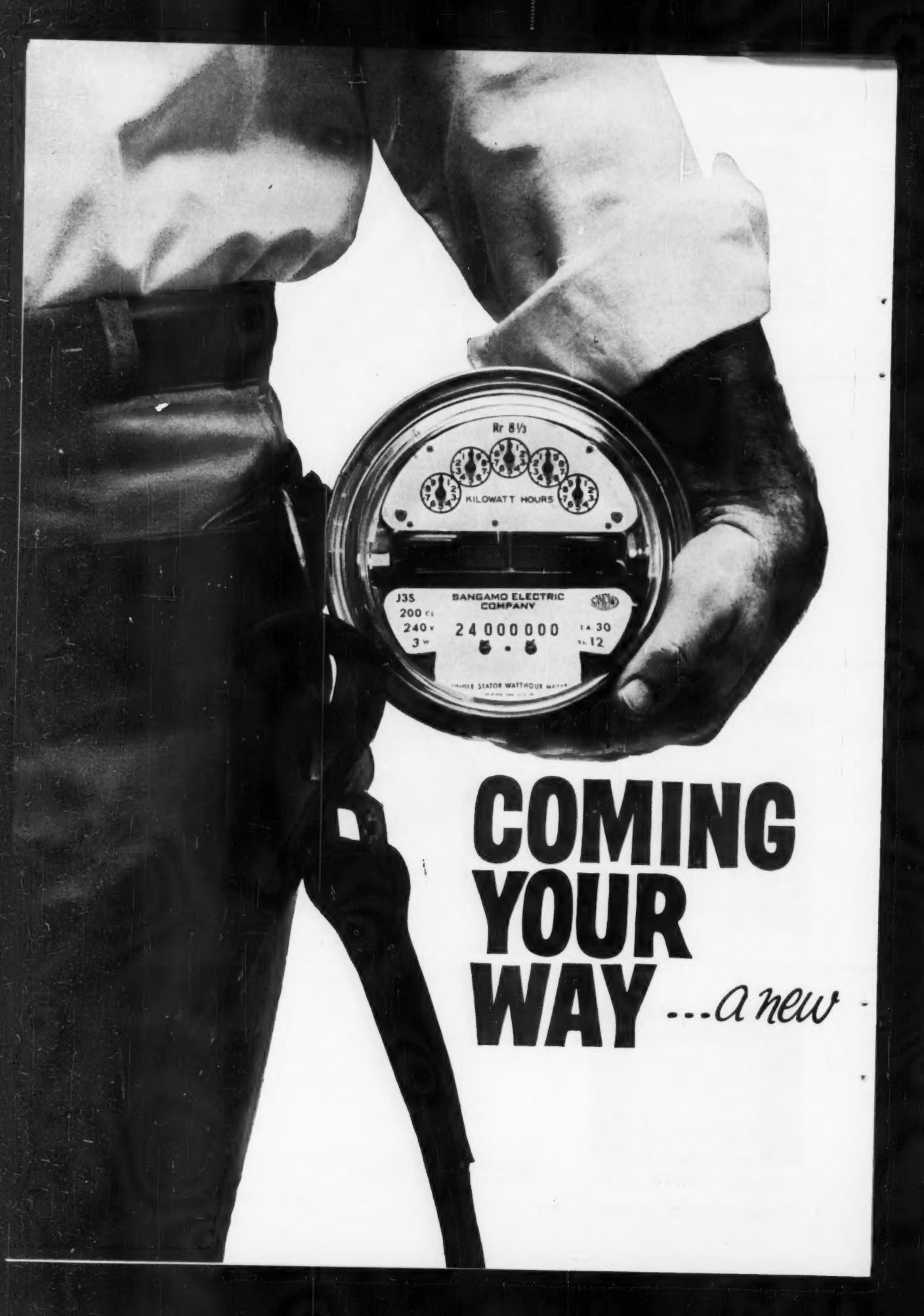
FIBERGLAS HOT STICKS
by BODENDIECK

Since 1952 BODENDIECK MEDALLION FIBERGLAS HOT STICKS have undergone the most important test of all . . . actual field service. Their outstanding performance has established them as the unsurpassed standard for the industry. Greater strength, lighter weight and superior moisture resistance are but a few of MEDALLION HOT STICK qualities.

Get the full story on "field proven" MEDALLION (premium grade) and new GLASTRUX (fiberglas sticks priced only a little higher than wood) plus catalog 58. Write today or use the convenient reader service card.

BODENDIECK TOOL CO., / TAYLORVILLE, ILLINOIS

CIRCLE 75 ON READER SERVICE CARD


Rr 8⅓
KILOWATT HOURS
J3S
SANGAMO ELECTRIC COMPANY
200
240
3
24000000
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12
COMING YOUR WAY ...a new

THIS IS THE ONE, developed to meet your needs... the Sangamo J3 Singlephase Watthour Meter. No warmed over, weary, compromise copy this. No follow the leader, last-with-the-least version of any other meter in the world. This is the J3... the only meter with true magnetic flotation. The one new, noteworthy development in watthour meters this year. One of the exceptional advances in metering in any year!

The Sangamo J3 has these new features:

TRUE MAGNETIC FLOTATION... the moving system of the J3 is not suspended, supported, harnessed or trapped. It floats, pure and simple, permanently and without friction, on a field created by Alnico magnets that are dimensionally and magnetically uniform.

VISIBLE, SELF-CLEANING GAP... because the magnets repel each other, the gap stays clean; it cannot be bridged by metal particles.

CONTROLLED FLOATING SYSTEM ... in the J3, endshake is controllable to assure best performance on high loads. The dual damping magnets in the J3 substantially reduce side thrust, and tilt-error is insignificant. These features, combined with the unique slow speed of Sangamo J Meters, give you a moving system that is *guaranteed for life.*

ADVANCED INSULATION LEVEL... Epoxy-coated current coils, proven on Sangamo polyphase meters, provide better insulation, facilitate heat dissipation.

SMALLEST SIZE... the J3 is smaller than other meters, making it easier to handle.

NEW DESIGN... provides better visibility for inspection and testing.

Plus these traditional Sangamo advantages:

HIGHEST TORQUE... up to 15% more than that of any other meter.

SLOWEST SPEED... 40% fewer revolutions than any other meter.

LOWEST STARTING WATTS... starts to operate before any other meter; requires 25% fewer starting watts to begin measuring; total watts loss is lower.

SECTIONALIZED CONSTRUCTION... any component can be inspected and replaced without completely disassembling the meter. Many parts are interchangeable with J and J2 meters.

CORROSION RESISTANT FINISHES & MATERIALS... end maintenance problems caused by weather and atmospheric conditions.

GLASKYD BASE... with tremendous impact strength that shrugs off rough treatment. Has better arc tracking resistance, too.

Your Sangamo Representative is coming your way with a sample of the new J3. Probe, pry, pore over it. Write it into your standards. Then, put it to work... for this has everything you want in a watthour meter. And that's a promise, for this is one of the really great ones.

watthour meter...the Sangamo

true MAGNETIC flotation

J3

SANGAMO ELECTRIC COMPANY/ SPRINGFIELD, ILLINOIS

JM60-5

HOW TO SEAL LEAKING TRANSFORMERS

No welding or soldering . . . no special equipment . . . five minute's labor. With Epoxylite® Black Sealer Paste, you can stop transformer leaks in a matter of minutes—no disassembly required, no expensive down-time involved. Simply wire brush the bonding area, stir the catalyst into the Sealer Paste, and apply. Catalyzed paste stays right where it is put, sets hard in a few hours.

The Black Sealer Paste is now being used by more than 150 utilities and over 200 motor repair shops in dozens of time- and money-saving applications, for on-the-spot repair of transformer bushings, cracked terminal boards, chipped commutators . . . used to seal leaking oil-filled cables, waterproof connections, bond brush-holder studs.

One customer saved over $135,000 in two years through use of Epoxylite in a single one of 20 applications. Admittedly, that's exceptional, but many customers frequently save the cost of the entire kit through the use of a single one of the jars.

Epoxylite Sealer Kit #1 contains twenty jars of the Black Sealer Paste—each jar enough for one maintenance or repair application. The handy, versatile Kit #1, complete with full instructions, is priced at $28.80, f.o.b. El Monte, California.

Prove to yourself that you can save money in dozens of electrical maintenance and repair applications by ordering a kit today. To place your order, on a satisfaction-guaranteed basis, write or phone:

THE EPOXYLITE CORPORATION

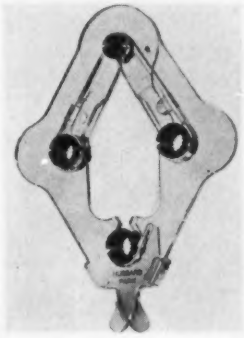
P. O. Box 3397, El Monte, California
CUmberland 3-8231

or, for a full description of the Kit and a list of 21 proven uses, please write for our free literature.

Circuit Tester . . .

. . . rings out as many as 140 wires automatically for continuity, insulation resistance and faults. The Automatic Circuit Analyzer indicates the nature of any trouble found and shows where in a circuit it is located. The device tests multiples of 35 wires; special orders can also be filled. The leakage selector is adjustable to 1, 20 and 100-meg-ohm ranges.

Rohr Aircraft Corp, Chula Vista, Calif. (20)



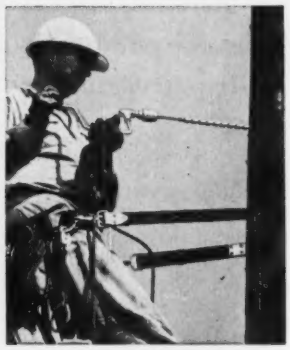
Cable Spacer . . .

. . . supports aerial cables spaced 6 in. on centers. The polyethylene grommets slip over conductors and messenger, then into the plexiglass spacer, which is snapped closed to make the whole an integral assembly. A line of aerial-cable tangent, pole-top, corner and crossarm mounting brackets, plus grommets for all standard cable sizes are available. The brackets are of hot-dip galvanized steel.

Hubbard and Co, 200 S Michigan Ave, Chicago 4, Ill. (21)

New Irwin Pole-Bor Bit

gives non-stop boring



No stopping to clear chips, not even in creosoted poles

Now get easier, faster, non-stop boring action in telephone and power poles with the new Irwin 415T Pole-Bor bit. Chip flow is continuous. Special Irwin cutting head, twist angle, and smooth-polished hollows eliminate clogging and binding — even when boring clean through creosoted poles. Spur on head outlines hole ahead of cutting edge. Side lip then smooths hole, making it easier to insert bolts or pins.

And Irwin's exclusive and patented Adapter Shank chucks perfectly in both hand braces and electric drills to cut inventory costs by 50%, speed work on the job. All Irwin Pole-Bor bits are made of special high analysis steel, heat treated full length and machine sharpened for extra accuracy, longer life. Save time, save money. Order from your Irwin distributor.

Overall Length: Approximately 18″, with 12″ twist, 6″ shank
12 Sizes: 9/16″ to 17/16″

Irwin Adapter Shank fits both hand braces and electric drills

Comes like this with taper square shank for use in hand braces.

Cut off taper square shank. Use in both hand braces and electric drills. No wobble, no run-out.

IRWIN Wilmington, Ohio
every bit as good as the name

Stripping Tool . . .

. . . removes high-density polyethylene insulation from hot lines in less than 5 min. The 3-lb device is heated red hot and slips over the end of a hot-line pole for stripping No. 6 to 750-MCM conductors. It also removes other thermoplastic and rubber insulation.

Hendrix Wire and Cable Corp, Milford, N. H. (22)

Mobile Platform . . .

. . . for overhead maintenance and installation work has leveling jacks for stability on uneven terrain. The Mobile Work Platform of all-welded steel is furnished ready to use. It is a single unit without loose parts. Platform height is adjustable.

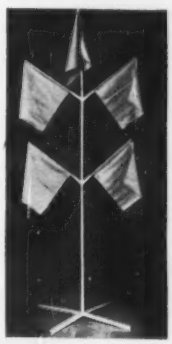
Atlas Industrial Corp, 849 39th St, Brooklyn 32, N. Y. (23)

Compression Tool . . .

. . . for hot-line work handles connections for wire sizes from No. 6 solid to 636 MCM ACSR. A partial turn of one handle sets the WH-2 hydraulic tool to compress or to retract dies. A high-speed hydraulic pump exerts 21,000 lb. thrust. Available handle lengths are 1 to 6 ft.

James R. Kearney Corp, 4236 Clayton Ave, St. Louis, Mo. (24)

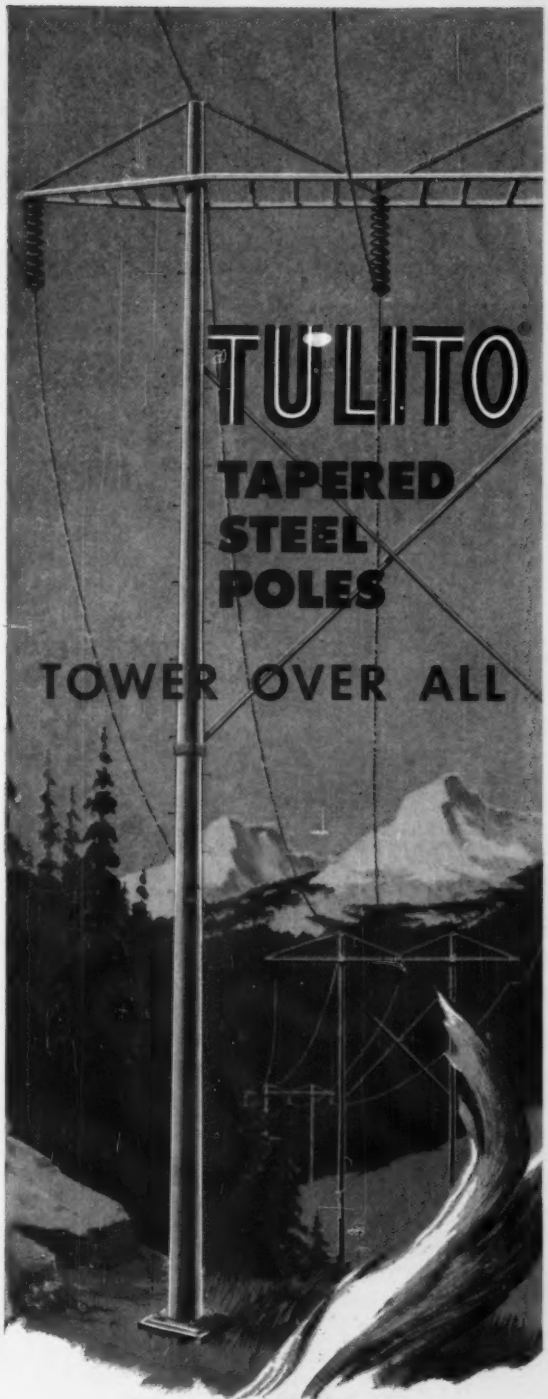
Flagstand . . .



. . . of yellow baked enamel holds five red-orange fluorescent flags, each 18x18 in. The unit is 80 in. high and weighs 23 lb. It can be disassembled for easy storage.

Eastern Metal of Elmira, Inc, Elmira Heights, N. Y. (25)

(More New Equipment on page 80)



Designed for **PERMANENCE**
Engineered for **DEPENDABILITY**
Equipped with Tulito Safety Clamps to insure workman **SAFETY** ascending—descending

Available with either steel or wood cross arms. For complete information write:

MEYER MACHINE, INC.
RED WING, MINNESOTA

CIRCLE 79 ON READER SERVICE CARD 79

for **Lasting Tack-**

GRAYBAR QUALITY TAPE

...Preferred and used because it meets TOUGHEST SPECS

Graybar Tape is manufactured under rigid quality controls to give maximum adhesion, long life, a no-ravel edge, superior tensile strength, lasting tack. Available nationally, and always fresh, Graybar tape is used and preferred by hundreds of utilities. On your next purchase order – and always – specify the best: Graybar Tape!

IN OVER 130 PRINCIPAL CITIES

Everything Electrical Graybar

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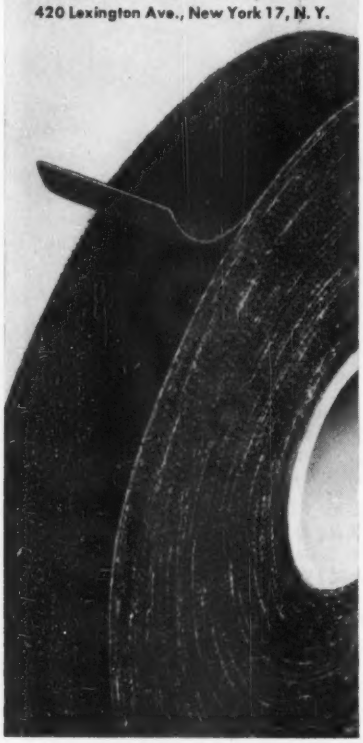
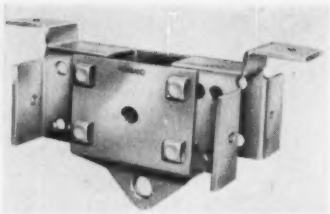
GraybaR

ELECTRIC COMPANY, INC.

420 Lexington Ave., New York 17, N. Y.





Insulator Fitting . . .

. . . for double-arm structures is adjustable to fit standard arm sizes. The adjustable phase fitting, which supports an insulator string suspended from the bottom hole, can be set to crossarms spacings from 8½ to 12½ in. in 1-in. steps. The units are made of galvanized ¼-in. steel plate. Side hole takes a V-brace.
Hubbard and Co, 200 S Michigan Ave, Chicago 4, Ill. (26)

Rainwear . . .

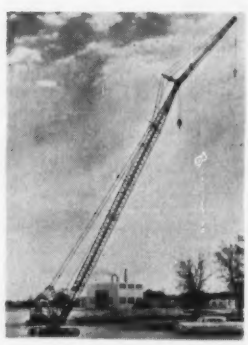
. . . of lightweight yellow Vinyl film with plastic buttons folds up to a compact, easily carried package. Jetsun clothing does not stiffen at —20F and is resistant to oils and acids. Sizes are medium and large.
Davis Emergency Equipment Co, 45 Halleck St, Newark, N. J. (27)

Marker Flag . . .

. . . warns crews of live parts. The 10½x11½-in. red marker flag, which is made of non-conducting semi-flexible plastic, hangs from a corrosion-resistant metal jaw, which can be clamped onto large or small conductors with a hot-line stick. For live parts not easily clamped onto, the flag can hang by a hook. The flag can be cleaned with paint thinner or with water and detergent.
Bodendieck Tool Co, Rt. 48 North, Taylorville, Ill. (28)

Panelboards . . .

. . . with main lug ratings to 600 amp now accommodate 2 and 3-pole, 15 to 100-amp breakers for power circuits as well as lighting-circuit breakers. Breakers can be plugged in on the job. Type NQO plug-in and NQOB bolted-connection panel boards are available.
Square D Co, 1601 Mercer Rd, Lexington, Ky. (29)



Crane-Excavator . . .

. . . is convertible for digging or lifting. As a crane model 14-B hoists 9 tons; available booms are from 25 to 80 ft long. Dippers of ½ and ⅝-cu-yd capacities are attached for use as a hoe or shovel. As a dragline clamshell

it handles buckets to ¾ cu yd.
Bucyrus-Erie Co, South Milwaukee, Wis. **(30)**

Gas Analyzer . . .

. . . for combustible or non-combustible gases requires no reagents for operation. The Analograph is usable in power plants as a leak detector and gas analyzer. This chromatograph device can be adapted to monitoring oil and nitrogen-filled high voltage cables.
Gas Purifying Materials Co, Inc, 3-15 26 Ave, Long Island City, N. Y. **(31)**

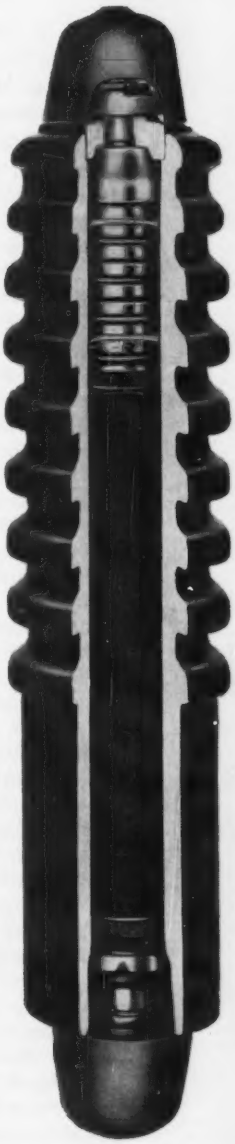
Pallet Truck . . .

. . . carries 2,200 lb. The hydraulic Pal-Jac is furnished in 21 and 27-in. width. Pumping the tow handle lifts the forks to a maximum height of 7¾ in.; pressing on the foot pedal lowers the load.
Raymond Corp, 144-182 Madison St, Greene, N. Y. **(32)**

NEW DS

CRYSTAL VALVE LIGHTNING ARRESTER WITH

BALANCED DESIGN



1. Assured Low Impulse Sparkover
2. Correct Discharge Voltage
3. Minimum Follow Current
4. Long Leakage Distance
5. Highest Factor of Safety

The Balanced Design of Delta-Star "Crystal Valve" Lightning Arresters gives extra protection and increases arrester life. The valve element controls, as it should, the follow current for interruption by the gap, and also provides conductivity for impulse and resistance for seal-off. The electrical characteristics of the special granular form of the unbonded oxidized silicon carbide, called Crystallite®, properly supplements the other design characteristics of the arrester to give a truly balanced design.

For full information on Delta-Star "Crystal Valve" Arresters write to . . . . . *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437-W. Fulton Street, Chicago 12, Illinois.*

DELTA–STAR PORTER ELECTRIC DIVISION

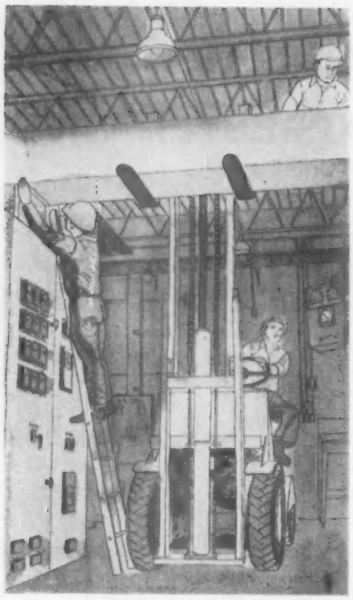
H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

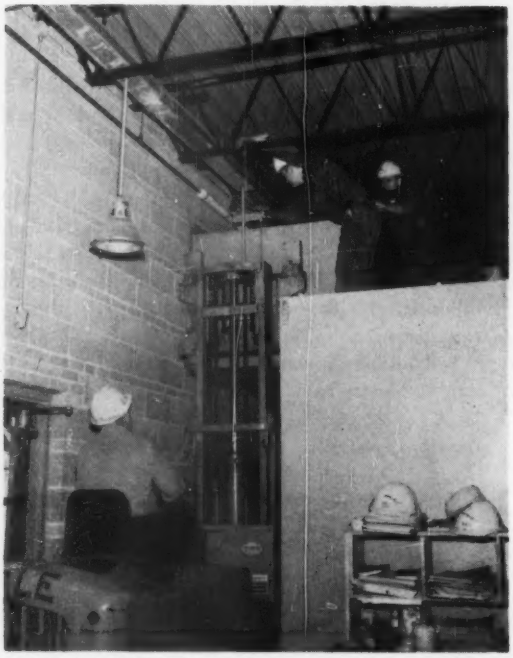
Fork Lift Truck Speeds Substation

GEORGE L. CURTIS, Crew Foreman, Substation Construction,

WILLIAM C. LOVE, General Foreman, Substation Construction, Union Electric Co, St. Louis, Missouri



ISOLATED PHASE BUS DUCT is lifted gently into place across a wide aisle



OVER A NARROW AISLE a section of isolated phase bus is positioned, after being carried by two fork lifts

Efficient handling and installation of equipment and material for Union Electric's new Poplar Substation resulted in appreciable savings in construction costs and in faster completion of the job. A fork-lift truck played a key part in the work.

Poplar Substation has two 90,000-kva, 138—13.8-kv transformers supplying eight 1,200-amp network feeders and four 1,200-amp system feeders through indoor metalclad switchgear housed in a 30 x 80-ft building.

There are four 3,000-amp and 12 1,200-amp air circuit breakers in the installation. Ties between switchgear sections indoors are in bus duct; connections from the transformers outside to the indoor switchgear are weatherproof isolated phase bus.

There is a railway spur into a paved area adjacent to the substation. The outdoor isolated phase bus duct was shipped in a railway automobile car with end opening. Some of the crates were 20 x 7 x 5 ft; the car was completely filled with crates and boxes of various sizes.

A fork-lift truck of two-ton capacity with a 10-ft lift was available and it was assigned to the project with a view toward saving time. There was no loading platform but by pulling the crates to a point where the fork lift could lift and carry, the unloading was simplified and man-hours were saved.

Some equipment was received in highway trailers and some in local trucks. All was handled safely and easily with the fork lift with the exception of the main switchgear units which were beyond the capacity of fork-lift truck.

However, the fork lift was a big factor in the handling of the switchgear. The units were unloaded with a crane onto rollers and towed or pushed into place using the fork lift. Some small switchgear units also were lifted and carried into place.

Switchgear in this station is in a double-row arrangement, with a wide aisle between facing similar units and a narrow aisle between switchgear and the building walls. Bus ties across the center aisle are made in overhead bus duct placed very close to the steel roof supporting beams. These bus-duct sections were lifted into place easily and quickly with the fork lift.

The two bus-duct units carrying the low-side transformer connections from the switchgear to the building wall weighed 5,500 lb each. They had to be

Installation

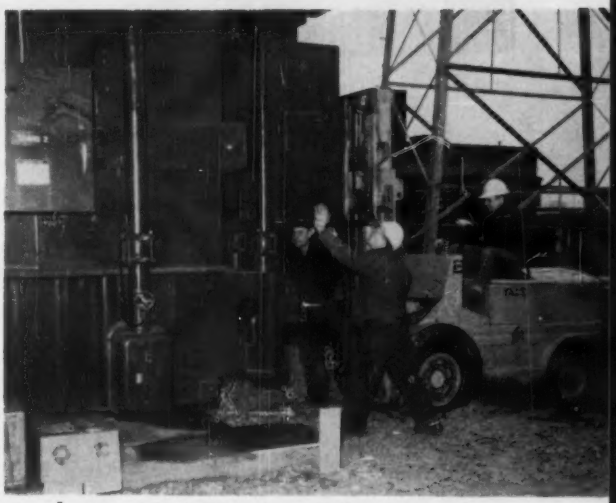
raised from the narrow aisle between the gear and wall to a position just under the roof beams. The aisle was just wide enough for passage of the fork lift. To get these units into place a second fork lift was brought in. The bus-duct section was placed so that it was supported on the forks of each truck and the trucks were then maneuvered into the narrow aisle, one truck moving backward and one forward until the proper location was reached. The duct was then raised gently and evenly into position.

The greatest value of the fork lift on this job, however, was in the handling and assembling of the 16 air circuit breakers with their 48 arc chutes. The breakers were received on skids and the arc chutes in individual crates. The fork lift was used to lift the breakers from the skids to the floor. It was of great help in uncrating the arc chutes, which for the 3,000-amp breakers, weighed over 600 lb each.

After the arc chutes were uncrated, it was found that a modification had to be made on each. This could not be done in the field so the 48 chutes were sent to the supplier's local shop. Instead of recrating the chutes, they were individually band-fastened to pallets and then loaded into a truck with the fork lift. Because they were on pallets, they could also be handled with a fork lift at the supplier's shop. When the modification was complete, the chutes were returned to the job on the pallets. Because the chutes had to be handled in an upright position after uncrating, the use of the pallets resulted in a very considerable saving in time.

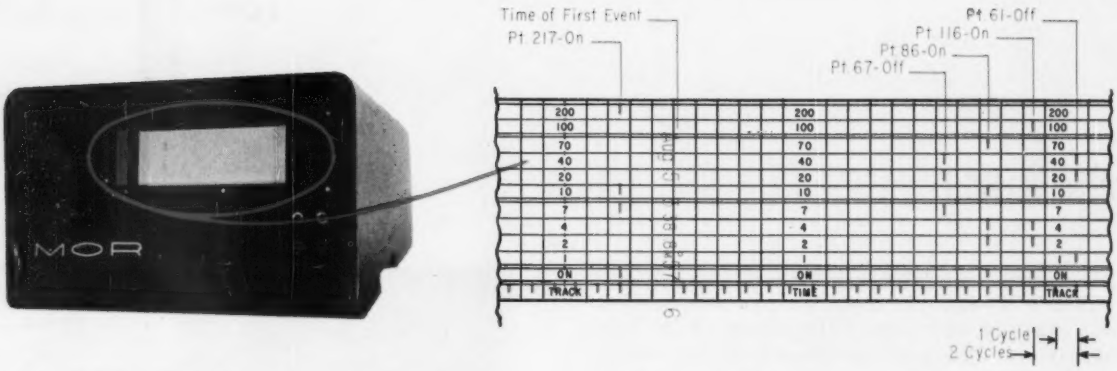
Assembling the chutes on the breaker proper with a fork lift has a lot of advantages over the use of a fixed overhead lifting device, such as a chain block. Hung on one of the forks of the truck, a 600-lb chute can be shifted easily backward, forward, sideways, or up or down until it is in the exact position for installation. It is not necessary to move the heavy breaker itself or to force the chute into position. The breaker can be placed in a convenient position and the chutes carried to it and installed with a minimum of physical effort and time.

Between doing the above jobs, the fork lift was used as a mobile, variable-height platform during the installation of lighting conduit and fixtures, overhead cable trough and cable. This eliminated a lot of ladder-handling time. Heavy reels of cable also were handled safely and with ease and dispatch. When oil leaks developed in a couple of the lower transformer heat exchangers, the fork lift was driven outside and the exchangers were removed, the leaks repaired, and then the exchangers were replaced.



LEAKS WERE REPAIRED in heat exchangers, with a fork lift moving them to and from the transformer

ASSEMBLING ARC CHUTES on the breaker is easier with a fork lift. Physical effort and time are minimized



OPERATIONS RECORDER is triggered by the opening or closing of a "trouble contact" (reflecting an on or off state). An identifying point number and "on" are printed, the tape is set into motion, and the timing track is imprinted once per cycle. Actual time of an event is printed to the nearest 1/100th of a second. The tape runs for 12 cycles and stops unless another event occurs. Tape will run for 12 cycles beyond last event

Recorder Monitors 400 Points for Three Units

MOR HOUSING holds ten-point coding trays, decoding section, timing assembly and the unit power supply pack

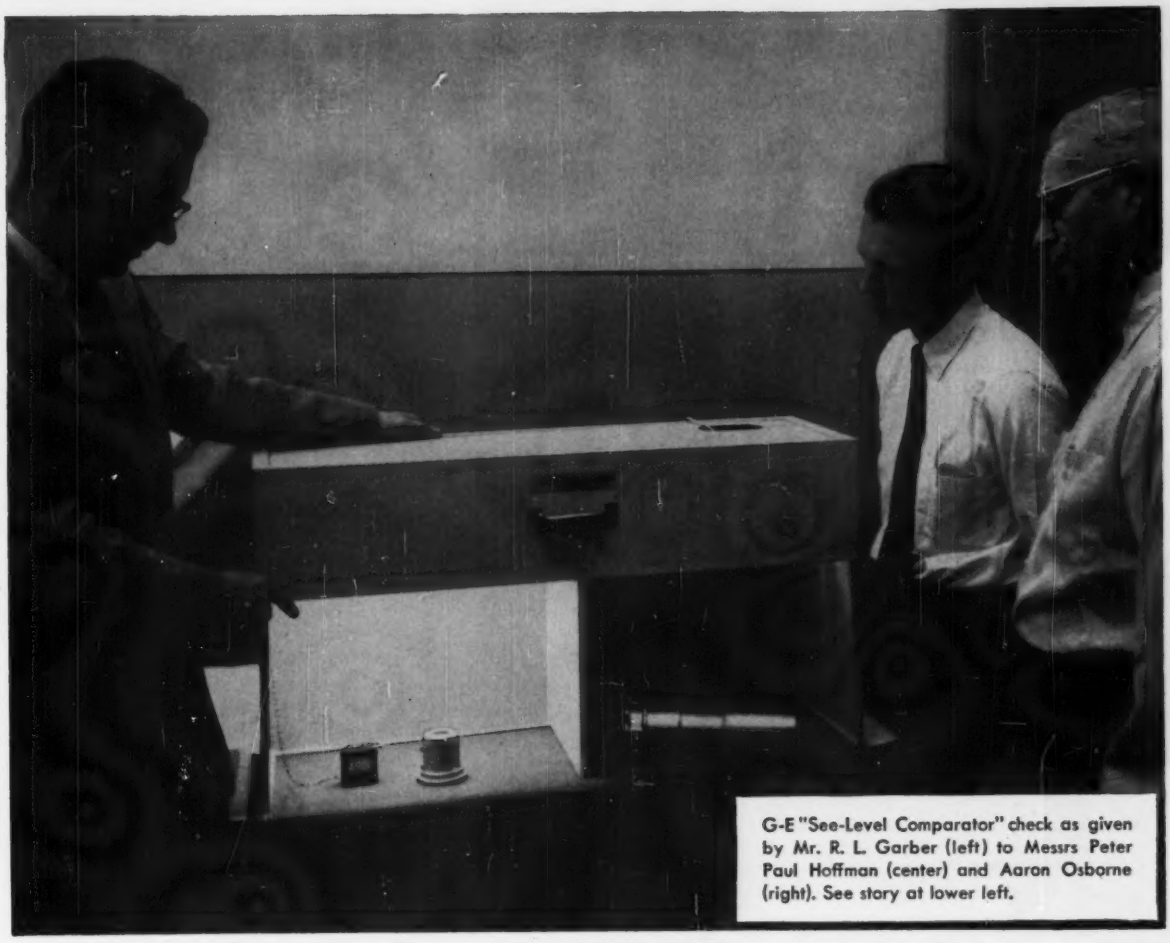
B. J. MARSHALL, Electrical Engineer, Florida Power Corp, St. Petersburg, Florida

For better analysis of outages and equipment failures, Florida Power Corp is installing an operations recorder to cover 400 points for the first three generating units at its Paul L. Bartow Plant. The equipment is being installed with the second 121-Mw unit, scheduled for start-up in 1961. It is a transistorized unit, the millisecond operations recorder (MOR-4), made by Fischer & Porter Co.

The present means of analyzing trouble is lengthy and cumbersome. This consists of strip-chart recorders, a 40-point, relatively slow, operations recorder (non-sequential) and the operator's memory of annunciator alarms. During trip-outs and in emergencies, conceptions sometimes vary afterwards as to what actually happened and what actually caused the emergency.

The new 400-point recorder is split up with 120 points for Unit No. 1, 120 points for Unit No. 2, and 160 points for Unit No. 3. Points covered include all auxiliaries and equipment that can initiate tripping of the boiler or turbine, either directly or indirectly. Also covered are all circuit breaker, plant, substation and certain protective relay operations.

By accurately pin-pointing all abnormal operations as to the initiating device, recording time off and time on, and recording all alarms in the sequence in which they occur, the recorder should show how other costly shut-downs may be avoided. Through correct analysis of these troubles, faulty design can be corrected and operating personnel can be better instructed to take care of future troubles and to shorten the length of outages of generating equipment.



G-E "See-Level Comparator" check as given by Mr. R. L. Garber (left) to Messrs Peter Paul Hoffman (center) and Aaron Osborne (right). See story at lower left.

HERE'S AN AMAZING DEVICE TO HELP YOU SELL YOUR CUSTOMER THE LIGHTING JOB HE REALLY NEEDS

New G-E "See-Level Comparator" works with *any* kind of lighting system!

Here are two of the many highly successful lighting jobs sold with the help of General Electric's new "See-Level Comparator". You, too, can use this sensational lighting tool to show your customers, in their own place of business and using their own products, the amount of light they actually *have*—and let them pick the lighting level they'd *like* to have.

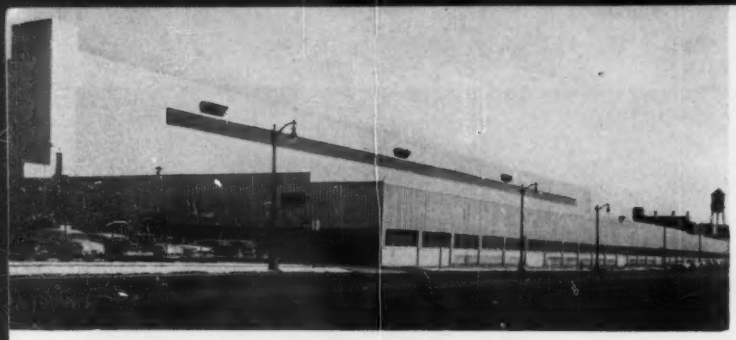
ALUMINUM CASTING AND ENGINEERING CO., Milwaukee, Wisc. Finding hairline cracks in castings is no easy task even under good lighting conditions. When Mr. R. L. Garber, Lighting Engineer with Wisconsin Electric Power Co., heard about this customer's plans for a 60-footcandle level, he asked Mr. Peter Paul Hoffman, vice-president, and Mr. Aaron Osborne, plant superintendent, to take the "See-Level Comparator" check. Both chose about 600 footcandles as ideal. Their own trained employees took the same check—and decided they could "get along" with 225 footcandles. So, 225 it is! And the cost of the job was increased by more than $5,000 (including lamps, fixtures, ballasts and wiring). About 2% of this would pay for the G-E "See-Level Comparator"!

JANTZEN INC., Portland, Oregon. Continued use of supplementary lighting after installing a 150 footcandle lighting system led Jantzen Mills' operators to give 6 employees the "See-Level Comparator" check. Each was asked to pick the minimum level of light he'd need for inspection jobs—and five picked 250 footcandles. The practically new (6 month old) system was boosted to 225 footcandles, and supplementary lighting has disappeared!

Discover for yourself just how good this exclusive tool, developed by General Electric, really is. Send for full information today. Write: General Electric Co., Large Lamp Dept. C-025, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Building was modernized by Edison crews

Disabled workers repair transformers

Apparatus repair bay has test generator

Garage handles 25 vehicles at one time ▶

Renovated Building Becomes New Service Center

Skill, determination and hard work transformed a semi-abandoned factory building into a centralized, streamlined service center and warehouse for Detroit Edison Co. The company paid $4.5 million in 1956 for a ghost of a building that had housed Lincoln-Mercury assembly lines for 20 years. Today, $11 million later, the renovated structure is the headquarters for nine Edison departments and some 40 warehouse, shop and service groups. It consolidates 26 widely scattered service centers formerly located in and around Detroit.

The original purchase included the property and seven buildings, some of which have been remodled while others were torn down to make room for new ones. Designated the Warren Service Center, the site covers 52 acres containing 1,070,000 sq ft of working space and railroad sidings. Space is available for parking 1,200 cars.

The motor transportation building is a new structure of 40,000 sq ft, servicing Edison's 1,200 vehicles. Offices, stock rooms and service shops are located in the one-story building.

Four warehouses were eliminated from Edison's supply system, as the new center provided 555,000 sq ft storage space. The Stores Dept now occupies two four-story factory buildings and part of a third.

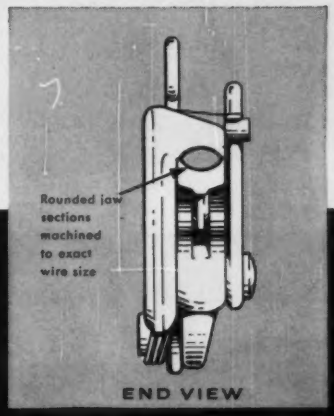
All salvage operations now are performed at Warren Center. With several widely scattered salvaging operations consolidated into the new warehousing facilities, an annual saving of $25,000 in handling costs is expected. The company also hopes to save $250,000 each year in reduced inventory and transportation costs through an overhead lines supply center at Warren Center.

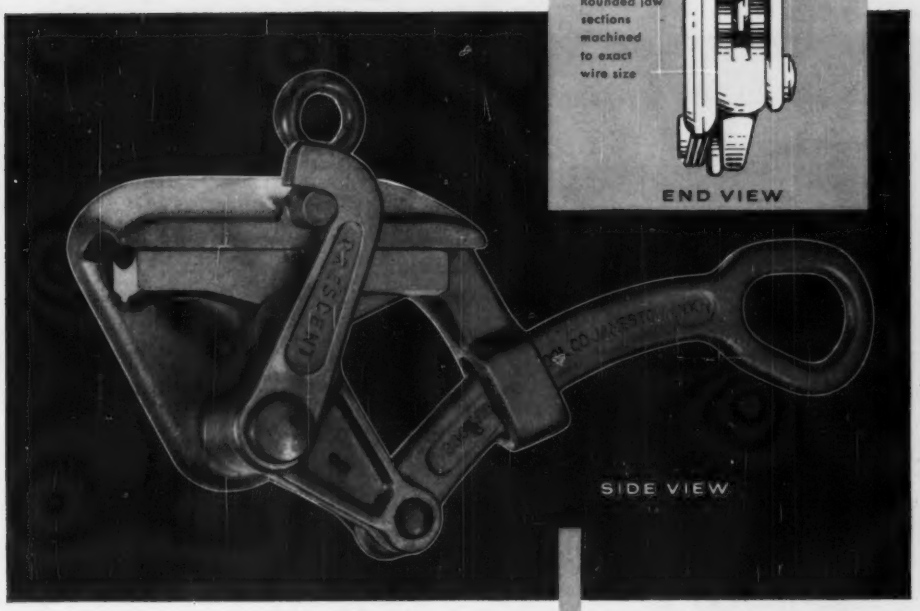
A large building on the property, remodled inside and out, houses facilities to repair, recondition and inspect large electrical apparatus, including a 250-kv test generator. Maintenance divisions headquarters at Warren Center will serve the entire company. Metal fabricating, carpenter, paint, and electrical shops are all under one roof.

Two buildings house the Overhead Lines Dept. Goodwill Industries and the League for the Handicapped lease space at the center and repair small appliances, small transformers and other light equipment under a contract with the company.

CRESCENT ACSR GRIPS

GREATER GRIPPING POWER WITH MUCH LESS WEIGHT





Crescent Grips for large sizes of aluminum wire are now available in three sizes listed opposite. Instead of the conventional V-shaped jaws, these Grips have rounded jaw sections, machined to a specific wire size, and will not crush or distort the wire. This design also greatly increases gripping power since there is practically 100% contact between wire surface and jaws.

These grips have all the quality features which distinguish other Crescent Wire Grips . . . jam proof, easily released, individually pretested to their safe load capacity of 12,500 lbs . . . *and they weigh only nine pounds.*

No. 386-20 is carried in stock. The other two sizes are made upon special order requiring about 20 days. All are cadmium plated.

SPECIFICATIONS

No. 386-20
for 795,000 CM ACSR, 26/7 strand.

No. 386-30
for 636,000 CM ACSR, 36/1 strand.

No. 386-40
for 477,000 CM ACSR, 18/1 strand.

Safe Load
12,500 lbs (5600 KG)

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

CONSTRUCTION

CREWS OF Wisconsin Electric Power are using 16 of these dollies for rear-lot work. Poles or equipment may be lashed to the 190 lb dolly

Dolly Hauls Poles and Equipment to Rear Lot Lines

A versatile dolly is being used by Wisconsin Electric Power Co to move poles, transformers, and materials to rear-lot locations without damage to lawns. The dolly can carry a load of 2,500 lb with ease; it turns within a 10-ft circle; and it collapses into a compact unit for transporting to and from the job site. The dolly was developed by William Thiermann of WEPCo.

Made from welded steel, the dolly has roller bearings and rubber-tired wheels for easy handling and for a minimum of "push" to get the heavy equipment to the job. A low-slung design gives the dolly a low center of gravity which minimizes the possibility of its tipping over.

Overall length of the dolly is 60 in; weight is only 190 lb. Automobile-type steering permits a turn on a very short radius. When the dolly is collapsed, its wheels lock and the handle pushes through the opposite end.

The dolly has a removable deck designed for bulky loads, such as transformers. A special folding cradle, used in place of the deck, facilitates the handling of poles. The dolly handled a test load of 4,000 lb; it has easily carried a pole, transformer, or other load weighing 2,500 lb. Wisconsin Electric Power has bought 16 of these dollies and has budgeted for three more.

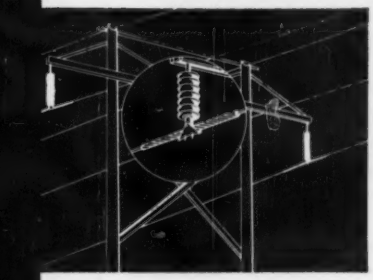
(More Construction on page 90)

*Superformed** means better

ACCURACY • UNIFORMITY • GRIPPING

...*for* overhead line CONSTRUCTION, PROTECTION, REPAIRS

SUPERFORMING is an exclusive patented process for helical wire forming . . . *developed* by Fanner, the earliest commercial manufacturer of machine-formed armor rods . . . *formed* by special Fanner-designed machines with unequalled accuracy, freedom from surface damage or cross-sectional distortion . . . *tested* with specially-devised equipment simulating most severe operating conditions . . . *backed* by an organization which has built on Integrity, Service and Quality . . . *SAVES MONEY* because application is fast, simple, requires no tools . . . reduces maintenance . . . extends service life of conductors. That's why *more and more utilities are using more and more Superformed Products.* A-1429A

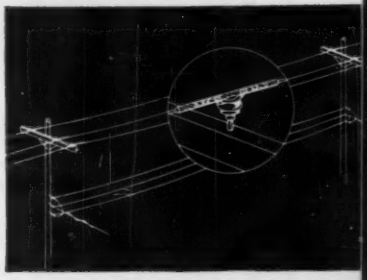


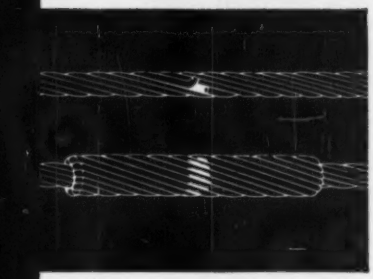
◀ ARMOR RODS

Protect against wind-induced and resonant-frequency conductor vibration at supporting points.

LINEGUARDS ▶

Protect at support points (and taps) in urban distribution where short spans are common; smaller wire sizes and shorter length than Armor Rods.



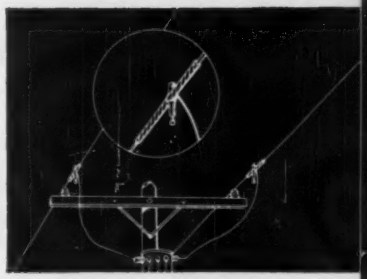


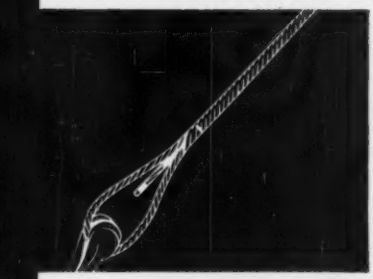
◀ PATCHRODS

Repair damaged or broken (up to 25% of strands) conductors, too far from support for Armor Rod to protect.

TAP ARMOR ▶

Protects where taps are required beyond extremities of Armor Rods on long spans or un-armored conductors.



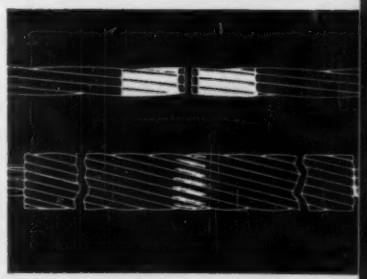


◀ FANNGRIPS

Provide ideal dead-ending and splices for wires, strands or cables for: Guys, Conductors, Multiplex Cables, Come Alongs, similar uses.

FANNSPLICES ▶

Join two ends of wire, or restore damaged conductors to original strength.



PLASTIC PRODUCTS FOR CONDUCTOR PROTECTION

Kover-Gard Ground Wire Moldings . . . Plastic Fannguards . . . Rigid and flexible Insulating Tubings. For field or factory application, wherever there is a real need for surface covering.

STOCKS . . . SERVICE

Fanner Superforms are sold and serviced nationally by 22 Manufacturers' Agents in 34 locations. Stocked by electrical distributors from coast to coast.

PACKAGING

Superformed Products go to you in pre-packaged sets . . . the correct number of rods, centermarked with identification. Also supplied in bulk.

*Trademark

Fine Fanner Superformed Products

THE FANNER MANUFACTURING CO.
Brookside Park • Cleveland 9, Ohio
Electrical Products Division

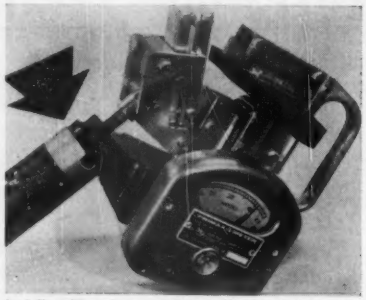
Licensed for use under or made in accordance with one or more of the following patents: Patent No. 2,587,521, 2,769,478, 2,588,863—Other patents pending.

APPLICATION DATA

Specification and ordering are made easy by Fanner Superformed Products Catalog EP-8. Contains 48 pages of Selection, Application, Installation information.

CIRCLE 89 ON READER SERVICE CARD

New HD PRIMAX-I-METER Installs Easier and Quicker!



Installs with only one "shot-gun" grip-all hot stick.

- Records maximum amperages on primary voltage in 15 minutes.
- Installs onto conductor with only one "shot-gun," grip-all hot stick.
- Scale range is 0 to 45 amperes.
- Accuracy—2% plus or minus at full scale.
- Weighs less than 10 lbs.

The exclusive HD PRIMAX-I-METER also features a 6" neoprene rubber insulator that's permanently installed in the transformer core opening. HD has serated and "V'd" the insulator, making it possible to install unit on bare conductor. "V" centers unit on conductor. Serations prevent unit from shifting or loosening due to vibrations or high winds.

Hot-line fitting design of HD PRIMAX-I-METER fits all makes of "shot-gun" hot sticks. You also save time by taking accurate readings direct from scale—no rates to multiply. Write or phone today for further informatoin.

FREE CATALOG DATA AVAILABLE

HD ELECTRIC COMPANY • DEERFIELD, ILLINOIS

CIRCLE 41 ON READER SERVICE CARD

GENTEX Electrical Safety Hat delivers 25,000 Volts dielectric resistance with Lightweight all-day Comfort

Brim or peaked cap models weigh from 12½ oz. to 12⅞ oz. complete, yet resist impact of more than 40-foot pounds, and penetration resistance exceeds Federal specifications.

SAFE. No shock hazards: no holes, bolts, rivets or metal—and a full 25,000 volts dielectric resistance! Smart, smooth, all polyethylene shell won't crack at brim or crown, even if dropped on concrete.

COMFORTABLE. Men keep Gentex hats *on* for constant all-day protection. Six-point suspension system, balance-designed on same principle as jet pilot's helmet, eliminates neck muscle strain. Exclusive no-wrinkle contoured headband can't put pressure on temples. Free ventilation for cool comfort.

Snap-in nylon and plastic headband with fingertip adjustment, fully washable. 9 job-coding colors. Non-conductive, adjustable, self-storing chinstrap. Non-conductive winter liners also available. *Write for full details to:*

GENTEX CORPORATION ■ 450 7th AVE., ■ NEW YORK 1, N.Y.

Prestressed Poles

L. H. SCOTT, System Distribution Engineer, Florida Power Corp, St. Petersburg, Fla.

Florida Power Corp is rapidly expanding the use of prestressed concrete poles for street lighting standards. Prestressed poles are economical and attractive, and may be installed using conventional methods.

For the past five years, Florida Power has been developing the use of concrete distribution poles. First models were cast-reinforced concrete poles designed by Florida Power and manufactured by a local contractor using the utility's forms (EW, March 14, 1955, p 48). Several hundred of these cast poles were installed, about 50% being used for distribution poles in subdivisions or locations where a more attractive pole than wood was desired. The remainder were used as street lighting standards.

Strength and Quality Offered

Prestressed concrete poles now are being used instead of the cast poles because they offer strength, quality and economy as their chief virtues. Two prestressed concrete companies in Florida are making prestressed poles.

Concrete street lighting poles have been well received by city officials and by the public in general. Probably the most important reason for the increasing use of prestressed poles is economy. A 35-ft pole, colored green, costs less than $90 delivered. Towns which previously could not have afforded anything other than wood poles for their "main street" lighting job thus can have attractive concrete standards. Almost all ornamental street lighting poles installed by Florida Power are prestressed concrete.

Originally the poles were painted light green; now the color is cast in the concrete, eliminating the need for painting and thus reducing maintenance costs. A light green color has been established as a standard. For street lighting use, the majority have been 35-ft

Offer Economy

GREEN CONCRETE POLES give many towns on the Florida Power system attractive lighting standards

poles, with a recent increase in interest in residential lighting using 30-ft poles.

Concrete poles are set at the same depth and in the same general manner as wood poles. Bolt holes for attachments are cast in the poles during manufacture. Standard dimensions have been established for hole locations so that a minimum number of holes are used and few clamps are required for attachments.

Standard Hardware Used

Standard line hardware is used on the poles. Slight modification of the street light bracket attachment has been desirable for a better fit on some poles. At present there are no standard dimensions or shapes for prestressed poles; cross-section shapes are octangular, triangular, or square with beveled edges.

Strength has been an advantage of the prestressed concrete pole. Various designs of poles are used depending upon strength requirements to meet conditions ranging from general street lighting to primary distribution. Overhead street lighting conductors may be deadended where necessary without excessive deflection of the pole.

(More Construction on page 92)

Now line crews can apply ground-line pole preservative

CHAPMAN®

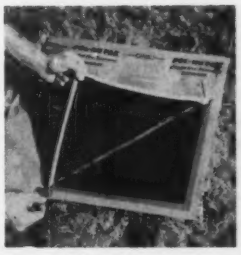
POL-NU PAK

Convenient, envelope-type ground-line treatment bandage for quick application wherever needed

Enlist your line crews in a system-wide effort to get longest service life from standing poles. With Chapman Pol-Nu Paks carried as standard equipment on service trucks, crews can apply ground-line preservative treatments to poles.

This convenient pole preservative bandage comes as a factory-sealed envelope containing Chapman Pol-Nu, the original grease-type pentachlorophenol preservative. Applied as shown in the steps below, it prevents errors and assures adequate Pol-Nu at the ground-line to restore natural loss of preservative in this critical area, resulting in many years of additional pole life.

Pol-Nu Paks are available in several sizes and, because of their convenience, are sometimes preferred for all ground-line treatment work. However, Chapman Pol-Nu in bulk containers and the Pol-Nu Bandage-Maker for preparing pole bandages in the field offer economies where many poles are to be treated. For information on both methods, using your own crews or contractor-applicators, mail the coupon below.



Slit Pol-Nu Pak on three sides to expose preservative.

Wrap bandage around pole at ground-line and staple.

Back-filling completes job, assuring longer pole life.

CHAPMAN CHEMICAL COMPANY

Leading manufacturer of wood preservatives • Memphis 1, Tenn.

Palo Alto, Cal. • Portland, Ore. • Minneapolis • Charlotte, N. C.

CHAPMAN®

POL-NU PAK

MAIL COUPON FOR COMPLETE DATA

Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.
Please send data on Pol-Nu Pak and information on extending pole life to:

*Name*_____

*Company*_____

*Address*_____

Save Time, Money Speed Installations with . . .

P-W

CABLE SUPPORTING SYSTEMS

P-W's TYPE "E" (PUNCHED BOTTOM) TRAYS—FOR POWER AND CONTROL CABLES AND INSTRUMENT TUBING—ALTHO LESS EXPENSIVE, ARE STRONGER, VERSATILE AND SUPERIOR. CONTROL CABLE CAN BE DROPPED OUT ANYWHERE.

Engineers, Contractors and Installers look for QUALITY, LONG LIFE, AND LABOR SAVINGS in their supports. That's why more and more users are turning to P-W. Among our outstanding improvements are: CONNECTIONS that are quick and easy to install—PRE-CUT SYSTEMS saving installation time—EXTENSION CONNECTORS eliminating field cutting to complete runs — ADJUSTABLE HORIZONTAL and RISER CONNECTORS to go over, under or around pipes, trusses, columns, etc. — BUILT-IN ADJUSTABLE DROP-OUT SECTIONS eliminate cutting out bottom of tray — STRAIGHT SECTIONS available in lengths up to 16' (33⅓% less connectors and less installation time over 12' lengths).

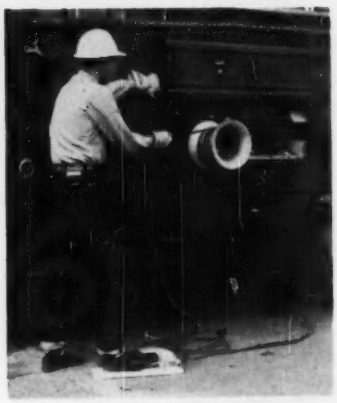
P-W SUPPORTS are available in hot dip galvanized steel or aluminum, in LADDER, EXPANDED METAL and SOLID TRAYS in addition to Type "E". All systems are interchangeable. Write for Catalog 858-A.

For the utmost in service, contact the appropriate Representative in your territory or P-W direct, regarding inquiries and placing orders.

P-W **INDUSTRIES**
11200 Roosevelt Blvd.
Philadelphia 15, Pa.

Foot Pedal Controls Winch From Truck-side

F. W. PECKA, Senior Assistant Distribution Engineer, Overhead Construction, Union Electric Co, St. Louis, Missouri



Much improved truck-winch operations have resulted from the development of a truck-side winch control system. The electrically-operated control plugs into a socket on either side of the line truck. The arrangement permits control of winch shaft rotation and speed with a foot pedal on the ground beside the truck and a throttle control on the side of the truck. The truck driver, formerly occupied in operating the winch controls from the cab, is released for other duties. The control system results in better coordination of the control of the winch with the construction activities.

The truck-side control unit permits one man to start and stop the rotating motion and govern the speed to suit the job. The operating controls consist of an electrical foot switch on the ground and a throttle control mounted on the side of the truck. Controls can be operated from either side of the truck as throttle controls and sockets for the foot switch are permanently mounted on both sides.

With the new control, the truck driver selects and engages the winch shaft gears in the cab in the normal manner. Then he is free to leave the truck. When the foot switch is plugged in, it energizes a solenoid controlling a vacuum cylinder that disengages the clutch, stopping the now rotating winch shaft. Depressing the foot switch breaks the clutch circuit, engaging the clutch and energizing a second solenoid valve causing a piston of a vacuum cylinder, near the carburetor, to actuate the carburetor throttle valve. The amount of throttle valve actuation is controlled by the setting of throttle control on the side of the truck. Releasing the foot switch pedal stops the shaft rotation and permits the truck engine to idle normally.

A unique feature is that the truck cannot be moved while the foot switch is plugged in, as the clutch is in a disengaged position. When the foot switch plug is removed, the throttle controls on the side of the truck become inoperative so that they do not affect the operation of the truck during other work.

WINCH CONTROL COMPONENTS consist generally of items and material that are available commercially. Some of the items were made locally, however

Specialists
IN
INDOOR-OUTDOOR
ENCLOSURES,
SWITCHES AND
TEST BLOCKS

KNIFE-TYPE, REMOVABLE LINK & SLIDE-A-LINK SWITCHES

Makers of the safe, sturdy, compact,
Roto-Test
2 POSITION TRANSFER OR CONTROL SWITCH

WRITE FOR LATEST BULLETINS

METER DEVICES
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CIRCLE 43 ON READER SERVICE CARD

ADAPTABLE
FOR ANY
MOUNTING
ARRANGEMENT

UNIVERSAL
STREET
LIGHTING
CONTROLS
MOUNTING
BRACKET

Send for Free Literature!

SunSwitch
DIVISION
RIPLEY COMPANY, INC. MIDDLETOWN, CONN.

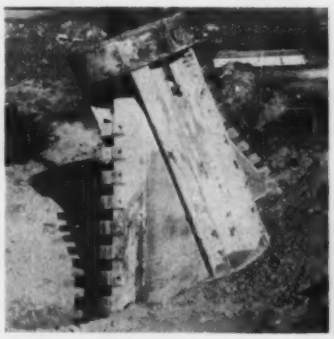
CIRCLE 42 ON READER SERVICE CARD

Underreamer Digs Tower Footing Holes

A new underreamer attachment used with a tractor promises to simplify construction of concrete anchors for transmission towers for Public Service Co of Colorado. Anchoring 6,000 lb of tower steel to earth can be a rugged job. Ordinarily, four huge holes are dug which have to be filled and packed after the footings are poured. Considerable labor and time may be necessary.

In using the underreamer, a 30-in. hole is first augered 12 ft deep. The reamer is bottomed in the hole and pressure makes its blades expand as it turns, undercutting a larger hole back toward the surface of the earth. The result is a pear-shaped hole having a 30-in. stem and a 5-ft diameter at the bottom.

The attachment is manufactured by Hugh B. Williams Co. PSC is using it on a D-4 Caterpillar tractor.



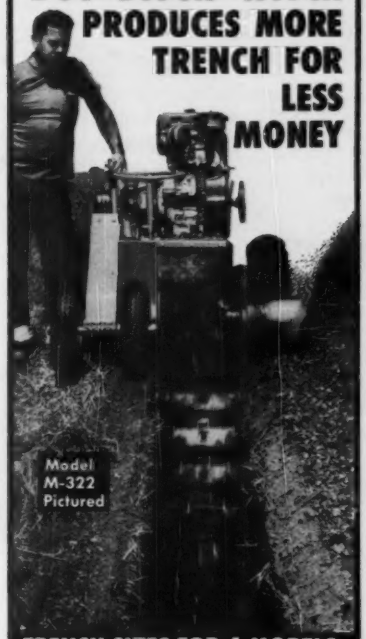
REAMER EXPANDS to dig a 5-ft hole at the bottom of a 12-ft shaft

CIRCLE 60 ON READER SERVICE CARD

"More or Less"
THE BEST
DITCH WITCH
TRENCHER

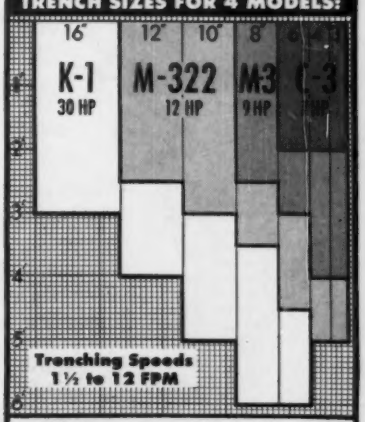
Other trenchers cost "More or Less"
Other trenchers dig "More or Less"

BUT DITCH WITCH PRODUCES MORE TRENCH FOR LESS MONEY



Model M-322 Pictured

TRENCH SIZES FOR 4 MODELS:



USE FOR:
• Utility Services
• Gathering Lines
• Signal Lines
• Sewer Laterals
• Road Crossings
• Sprinklers
• Footings, etc.

CHARLES Machine Works, Inc.
637 Birch St. • Perry, Okla.

To Locate Distributor, Look Under "Contractors Equipment" in 1960 Metropolitan Telephone Directory Yellow Pages for Ditch Witch Trademark; or Call Collect FE 6-4404, Perry, Okla.

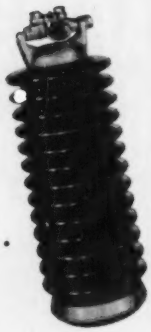
CIRCLE 93 ON READER SERVICE CARD

CLAMP

THE LAPP CLAMP IS INTERCHANGEABLE

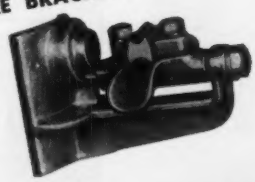
Five sizes of clamps, in aluminum or malleable, each with reversible keeper, provide correct fit for all conductor sizes .25″ to 2.00″ dia. All clamps are interchangeable for use on

CLAMP-TOP LINE POSTS . . .



CLAMP-TOP LINE POSTS WITH INTEGRAL BASE-AND-GAIN FOR ARMLESS CONSTRUCTION . . .

CLAMP-TOP GROUND-WIRE BRACKETS



-TOPS?

THE LAPP CLAMP IS EASIEST TO INSTALL

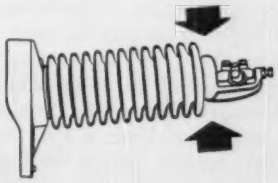
For original installation, insulator (or bracket) with clamp attached, is mounted to crossarm or pole. Keeper cap screws are loosened, and one removed. With keeper rotated out of position on remaining cap screw, conductor is dropped into place. Keeper is brought back to position, cap screw replaced, and both cap screws tightened. Cap screws have captive lock-washers so there is *only one loose part* per insulator throughout installation.

THE LAPP CLAMP IS EASIEST TO WORK WITH HOT-LINE TOOLS

No special tools required for insulator change-out. A trunnion cap screw is merely backed off, and conductor (with clamp attached) lifted out of position. The same clamp will slip into position in a replaced insulator and be secured by tightening trunnion cap screw. *No loose parts* throughout insulator change.

THE LAPP CLAMP-TOP IS MOST DEPENDABLE

A principle of Lapp Post design is the *external* attachment of hardware—*bases and caps.* This assures that the porcelain body be loaded only in large-area low-intensity compression. This design takes full advantage of porcelain's superior compression strength, and provides an assembly greatly more secure than one subject to the high-intensity tension loading introduced by internal pins and inserts.



Lapp

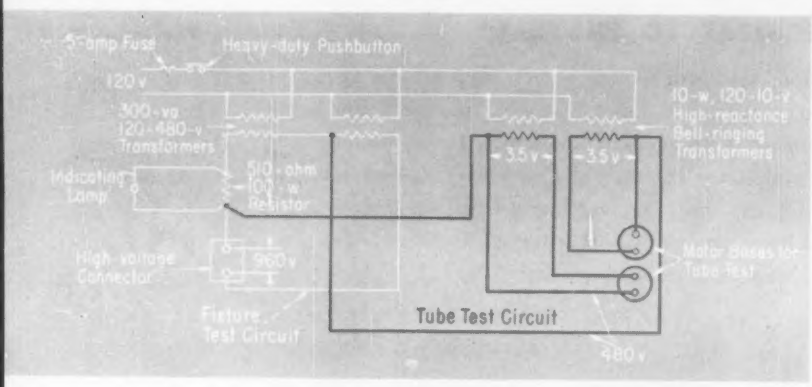
For new ideas on economical, efficient line and station construction read the new Lapp Catalog Eight. For your copy, write Lapp Insulator Co., Inc., Le Roy, N. Y.

CIRCLE 95 ON READER SERVICE CARD

Compact Kit Tests Fluorescent Street Lights

R. E. BAUMGARDNER, Electrical Engineering Dept, Municipal Light & Power Dept, Ft. Wayne, Indiana

A compact fluorescent street lighting test kit has been developed by the Municipal Light and Power Dept of Ft. Wayne, Ind. The kit has solved the problem of removing fixtures from the pole for repair. It is light enough to use while working on a pole or from a vehicle.



With this test kit all component parts of the series fixtures can be checked, defective components can be detected and the fixtures can be tested after repairs have been completed. This is all accomplished without the use of high-voltage series circuits. It makes possible safe and efficient servicing of fluorescent lights.

The test kit produces a simulated series street lighting circuit from a 120-v source and is capable of handling a fluorescent fixture of 432-w capacity. Testing is accomplished through a process of elimination of components, which include individual lamps, external and internal transformers and capacitors in the circuit.

This is the test procedure:

1. Tubes are removed and tested

Safe Limits Set for Fighting Electrical Fires

G. W. N. FITZGERALD, Electrical Research, Hydro-Electric Power Commission of Ontario, Toronto, Ontario

Tests made by Hydro-Electric Power Commission of Ontario to determine the limiting distances of safe approach when fighting electrical fires with fire-hose streams resulted in these conclusions:

Low-voltage circuits: With a minium distance of 5 ft from nozzle to electrical contact, no hazard should exist for all solid-stream hose nozzle tips up to 1¼-in. with a water pressure of 100 psi. Low-voltage circuits include all voltages up to 600 v to ground.

Hight-voltage circuits: Solid streams from straight tips up to ⅝-in. may be used with care, provided that minimum distances are maintained as listed.

- Solid streams from tips greater than ⅝-in. should not be used near live high-voltage equipment.
- Spray or fog streams may be used on any electrical equipment up to the safe working distance for the operating voltage of the equipment, as listed.

Tests were made by playing fire-hose streams on a metal target energized from a test transformer at lower utilization voltages up to the highest voltage (230 kv) on the Ontario Hydro system. Nozzles of various types and sizes were used with water pressures from 30 to 100 psi at the nozzle tip, using Toronto city water with a resistance of 1,800 ohm per cu in. at 8.5C. Tests were made on the basis of an allowable maximum leakage current of 3 ma in the water stream.

Nozzles were mounted on either an adjustable platform on the deck of a rubber-tired truck or on the boom of an aerial platform. Between the end of the hose and the nozzle a pressure-gage adapter was inserted to measure pressure at the nozzle. An insulated conductor was rigidly attached to the nozzle and connected through a milliammeter to the grounded side of the 60-cps test transformer.

Safe Approach Limits When Fighting Electrical Fires

Voltage (Kv)		Minimum Safe Distance (ft)	
To Ground	Circuit	⅝-in Solid Stream Nozzle*	Spray or Fog Stream Nozzle
2.4	4.16	15	4
4.8	8.32	20	4
7.2	12.5	20	4
8.0	13.8	20	4
14.4	24.9	25	4
16.0	27.6	25	4
25.0	44.0	30	6
66.5	115	30	8
130	230	30	14

* Nozzle pressure, 100 psi; water resistance, 600 ohm per cu in.

OPERATION & TESTING

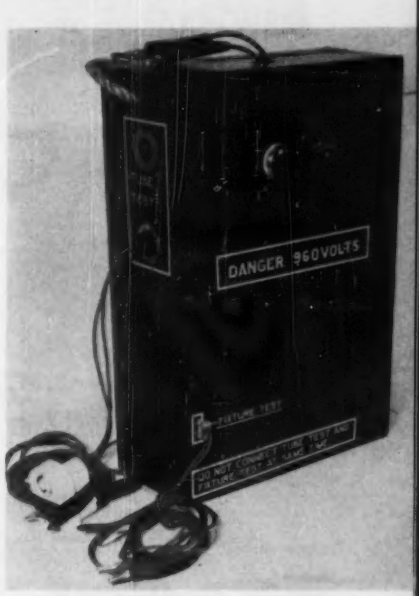
for burn-outs with the tube test circuit in the testing unit.

2. The IL transformer is disconnected from the fixture and the high-voltage leads of the test unit are clipped to the input leads of the fixture. The test unit is connected to a 120-v source and the circuit is energized by pushing a button. If the lamp fails to burn, a short circuit in the fixture is indicated by a glow of the indicator lamp. The test is also a check of the IL transformer.

3. When a short-circuit condition is indicated, the fixture is opened and the capacitor leads are disconnected from the circuit. The test voltage is applied again; the indicating lamp will show the condition of the filament transformer. This process isolates the short circuit and determines its location in the fixture. A visual inspection generally will locate other troubles.

The line fuse is an automotive cartridge-type holder with a 5-amp fuse. A heavy-duty normally-open pushbutton insures a dead-front condition. Normal operating load of the tester is 432 w, but starting requirements are higher. A 510-ohm resistor in series with the transformers limits the current after lamps are started. A type ET-5 indicating lamp provides visual detection of short circuits in fixtures.

In the fixture test circuit a small TV antenna-type high-voltage plug jack allows the high-voltage circuit to pass through the side of the box. A pair of test leads (35 ft of 5-kv flexible wire) is equipped with a male adapter for the high-voltage plug jack and alligator clips. A lamp-testing circuit checks lamps that fail to light, with a 120-10-v bell-ringing transformer providing power for filament heaters.



TESTING UNIT weighing 26 lb is housed in a 12x18x6½-in. box that handles easily in the air

The nozzle was positioned at a fixed distance from the target. Using various tips and water pressures, the voltage was raised on the target until a 3-ma current flowed in the water stream. For the low-voltage tests, a minimum approach of 5 ft was used. At this distance the leakage current was less than 3 ma for all tips smaller than 1¼ in. The limit of 3 ma was reached with a 1¼-in. tip at 30 psi.

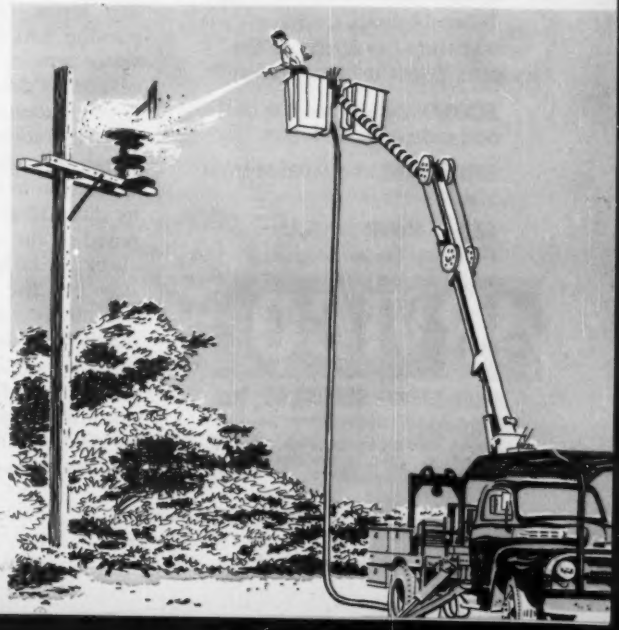
At voltages greater than 600 v, tests were made at distances from 5 to 30 ft. With smaller tips, the solid stream began to break up before hitting the target 30 ft away, with a resultant increase of resistance in the stream and hence a lower current.

With most straight-tip nozzles, the pressure at the tip materially affected the safe approach distance. With tips greater than ⅝ in. and a 100 psi pressure, approach to or contact with live electrical apparatus may be hazardous. The water stream from a ⅝-in. tip at 100 psi begins to break up into spray at about 20 ft from the nozzle. Therefore, water from a ⅝-in. tip may be used safely on live electrical apparatus provided a reasonable distance is maintained.

A comparison of various combination tips, which will give a spray pattern or a ⅝-in. solid stream, indicate that in the solid-stream position they should be considered as straight-stream ⅝-in. tips.

Test results showed that spray nozzles are safe for use within 3 ft of a circuit at 65 kv to ground. Such close approach should not be considered for hand-held lines, however. With account taken of the limits of safe approach to live circuits for trained utility personnel, safe-approach distances during use of spray or fog streams are listed in the table.

Demonstrations of the limit of safe approach have been made in the field up to circuit voltages of 44 kv using a portable transformer and gasoline-engine-driven power supply. Working with the office of the Fire Marshal of Ontario, about 3,000 Ontario Hydro personnel and municipal fire fighters have attended demonstrations during the past year.



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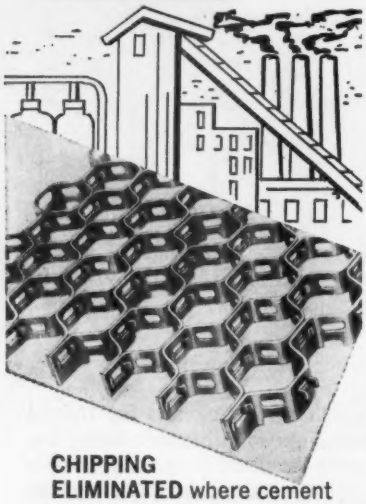

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Reclaim Condensate From Feed Pumps

A. R. LIVELY, Assistant Shift Supervisor, Cabin Creek Plant, Appalachian Power Co, Cabin Creek, W. Va.

A significant reduction in the loss of condensate is achieved by changing the packing gland quenching water from service water to condensate on six boiler feed pumps and six tank pumps. This change was made after tests showed that condensate losses through these packing glands could amount to almost 38 million lb per year, an amount lost if service water used as quenching water contaminates the condensate.

The change was suggested after tests revealed that each packing gland (two per pump) on these 12 pumps has an average leakage of 1½ qt of water per min. This is a significant amount when taken on a 365-day basis. The loss takes place whether the pumps are running or not, because a spare tank and boiler feed pump is maintained on standby for each unit, with suction and discharge valves open.

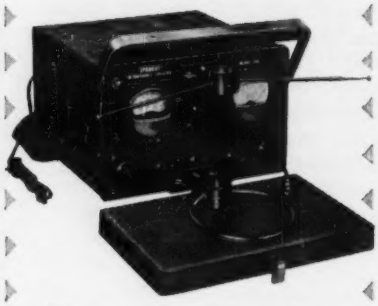
In the new arrangement, quenching water is supplied through short valved-connections from the condensate sealing water system for the boiler feed pumps and through a 1¼-in. branch from the turbine sealing system for the tank pumps. Both sources provide condensate cool enough to use as quenching water. The discharge for packing leak-off and quenching water now is piped to the miscellaneous drain tank from where it can be returned to the cycle.

Metal covers made for each gland drain box prevent the condensate from being contaminated by dirt. Oil slingers were left exposed so the operator may easily check for oil leaks. This is necessary because oil contamination will not be recorded on the conductivity recorder. This precaution is necessary, although the chances of such contamination are practically nil.

(More Operation on page 100)

SPRAGUE®

MODEL 500 INTERFERENCE LOCATOR



This versatile instrument is a highly sensitive interference locator—*with the widest frequency range of any standard available unit!* Model 500 tunes across the entire standard and FM broadcast, shortwave, and UHF-TV spectrums from 550 kc. to 220 mc. in 6 bands.

It's a compact, portable, rugged, versatile instrument—engineered and designed for most efficient operation *in practical field use.* It features a transistorized power supply, meter indications proportional to carrier strength as well as sensitivity of 5 microvolts minimum for 5% meter deflection over entire tuning range.

For full details, send for brochure IL-106.

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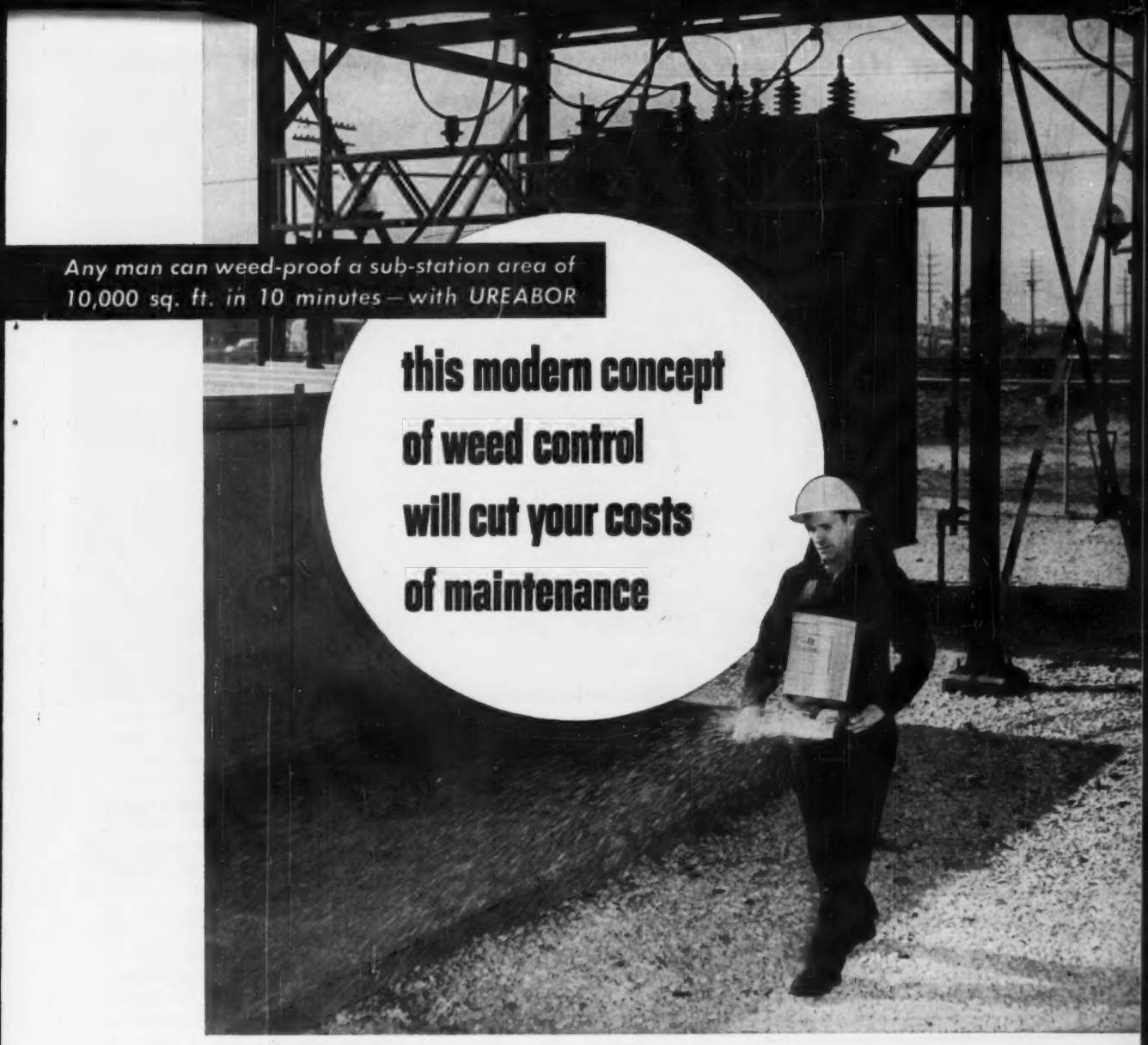
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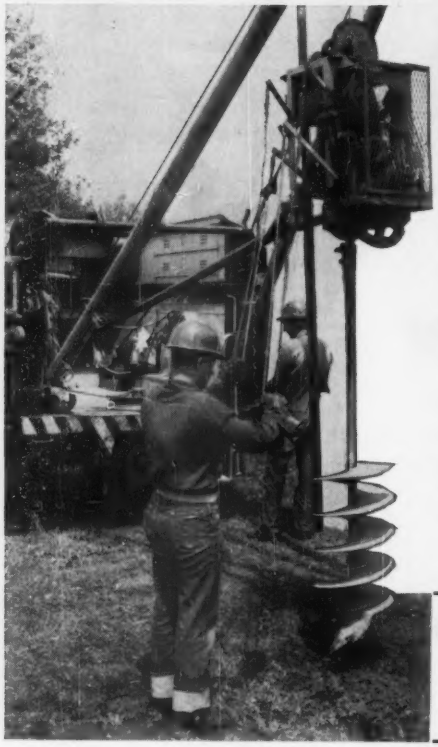

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Tall Crane Helps Remove Large Trees

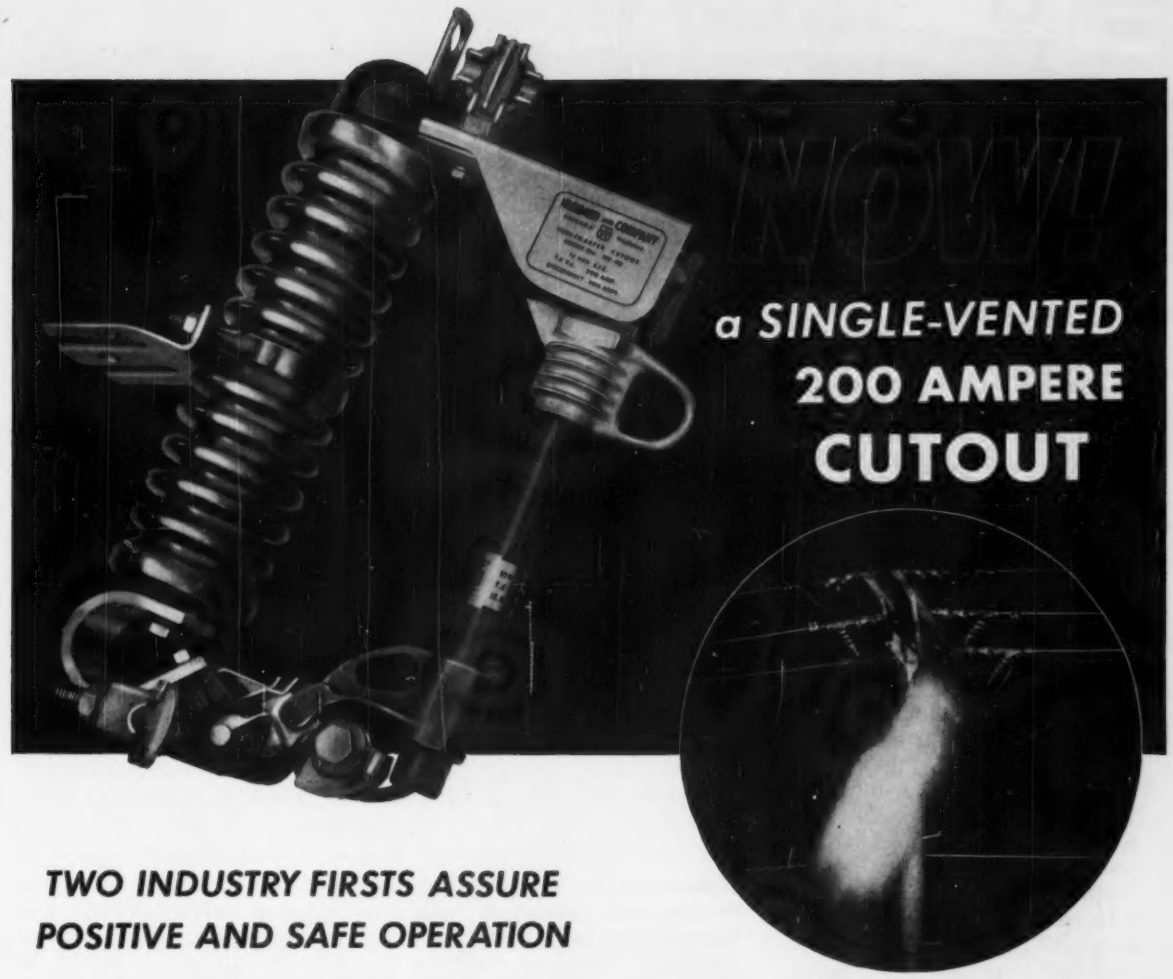
W. S. BRENNEMAN, Forestry Representative, Illinois Power Co, Decatur, Illinois

For efficient removal of large dead elm trees that overhang and endanger power lines of Illinois Power Co, Asplundh Tree Expert Co is using a 100-ft, telescoping, hydraulic boom. Trimmers are suspended from the hydraulically operated boom of the crane, thus eliminating the hazards involved in climbing these dead trees. The boom also removes the limbs, may of which are large and otherwise hazardous to handle. The boom is controlled from the ground.

To facilitate the boom operation, an Illinois Power Co crew operates a dump truck and an A-frame truck with winch. This crew uses the A-frame truck to load logs onto the dump truck, which hauls the logs to the dump. It does hauling for the hydraulic boom trimming crew and for a conventionally equipped trimming crew. Power tools are used for the actual trimming.

Evaluation of this operation is incomplete. However, the hydraulic boom removes the largest and most hazardous trees in about half the time required by a conventionally equipped crew of equal size. On smaller trees that are not rotted and do not greatly overhang the line, use of the boom results in a much smaller saving in manhours. Trees 100 ft or taller may require 40 man hr of "boom" crew time and 10 man hr of A-frame-winch crew time.

CIRCLE 61 ON READER SERVICE CARD



TWO INDUSTRY FIRSTS ASSURE POSITIVE AND SAFE OPERATION

NOW... The Hubbard Roll-Action fuse ejector... a new development in 200-ampere cutout operation... offers a positive means of ejecting 1, 2 and 3 leader fuse links in the 100 to 200-ampere range—thus preventing arc restrike during fault interruptions.

Coupled with this development is the pressure-maximizing effect of the small bore fuse tube for rapid clearing of low faults. Therefore POSITIVE operation for all fault currents is assured.

NOW... Hubbard Single-Vent Small-Bore operation... another new development for 200-ampere cutouts... assures SAFETY for personnel and equipment because only a single-vented cutout operates with a single confined cone of gases, discharged downward—eliminating dangerous "shrapnel" and conducting gases blown into the overhead structure.

HOW is this possible with interrupting capacities of 12,000 amperes at 7.8 kv and 10,000 amperes at 15 kv? Only through Hubbard's exclusive thrust-absorbing recoil mechanism and fiber glass fuse tube—first made available in Hubbard's 100-ampere EHD line.

Also manufactured in Canada by N. Slater Co., Hamilton, Ontario

BETTER PRODUCTS *through Creative Engineering*

HUBBARD

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Formula Sets Time for Breaker Inspection

ROBERT L. WARE, System Manager —T&D, Virginia Electric & Power Co, Richmond, Va.

Virginia Electric & Power Co uses a formula to determine when an internal inspection of circuit breakers should be made. This formula takes into consideration the type of breaker, the severity of interrupting duty, the number of fault operations since the last inspection, and other factors.

It has been in use over five years, and enables maintenance personnel to make internal inspections at the optimum time. The formula is used with a curve to determine the number of operations allowed before internal inspection of a breaker is needed.

To use the formula, the group multiplier (GM) is selected (from Table I) to cover the particular breaker involved; the class multiplier (CM) also is selected (from Table II). The class multiplier is based on the maximum calculated fault current divided by the rated maximum interrupting current, expressed as a percentage. Maximum calculated fault current is taken as a bolted bus fault.

The formula is solved for a value called the operations multiplier (OM). This multiplier value then used to locate a point on a curve of the relation between the OM values and the maximum permissible number of breaker operations under fault between internal maintenance inspections.

To illustrate the use of the formula, assume that an outdoor 15-kv, 100-Mva oil circuit breaker is used on a bus having 90-Mva duty. The GM for this breaker is 1.5; the CM is 5. Substituting in the formula shown:

$$OM = \frac{50}{1.5 \times 5} = 6.67$$

From the graph, the maximum number of permissible operations corresponding to 6.67 is 15. On this breaker an internal inspection should be made after 15 operations under fault. If this breaker had locked out twice since the last internal inspection, permissible operations would be reduced by 4. Therefore, an internal inspection should be made after 11 operations under fault including lockouts. VEPCo also feels the maximum time between internal inspections should be four years regardless of the number of operations.

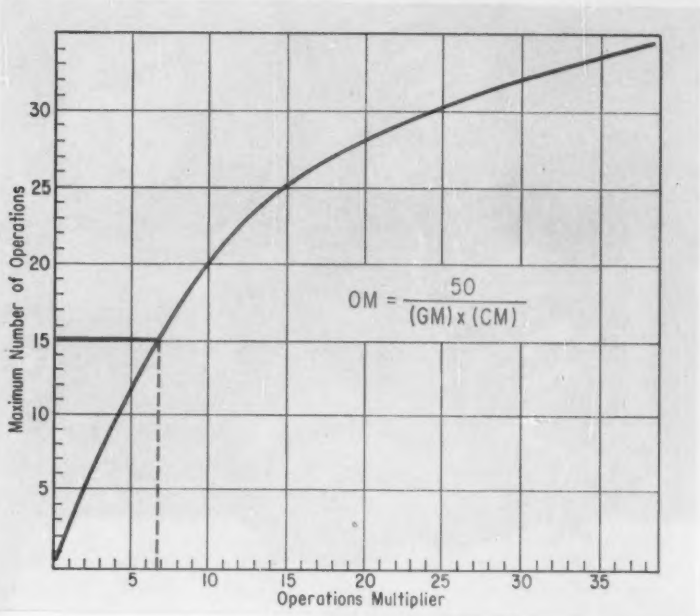

Table I—Multipliers for Circuit Breaker Groups

Group Number	Indoor	Group Multiplier*
1. Air CB	All	Below 100 Mva 1
2. Oil CB	Below 100 Mva	1.5
3. Air and Oil CB	100 Mva and above	1.5
	Outdoor	
4. Thru 23 Kv	Thru 100 Mva	1.5
5. Thru 23 Kv	Above 100 Mva	2
6. Above 23 Kv	Thru 73 Kv	3.5
7. Above 73 Kv		6

* The group multiplier should be doubled for all OCB's built before 1930.

Table II—Class of Service Based on Severity of Duty

Class	Class Multiplier
A—Over 95% of rated duty	7
B—85% thru 95% of rated duty	5
C—70% thru 84% of rated duty	3
D—50% thru 69% of rated duty	2
E—0% thru 49% of rated duty	1
F—Multiple capacitor banks	(a)
G—Single capacitor bank circuit breakers	(b)

(a) See specific instructions for each bank.

(b) Should be maintained according to experience encountered at each location.

National's novel potting technique gives rigidity to giant Accelerator coils

The problem was to produce 220 guide magnet coils for the Cambridge Electron Accelerator. The coils, each 154 inches long, have to be strong enough to withstand the force of the pulsating magnetic field.

As the coil cross-section indicates, all stiffness and shape is a function of the potting resin. National first insulated the conductors and copper cooling tubes from each other with glass fiber tape barriers. The whole coil was then embedded in a catalytic type resin, and cured in special molds to requisite mechanical strength and electrical properties. Final step was insulation to ground.

National's experience and know-how in getting the *most* out of any insulation is at your disposal. Whether your electric coil requirements are standard or special, call National. In Columbus... HUdson 8-1151; sales engineers in all principal cities.

M.I.T.-Harvard Cambridge Electron Accelerator. The bending magnets and coils focus a beam of electrons during acceleration from an initial energy of 20 million electron volts to a final energy of 6 billion electron volts.

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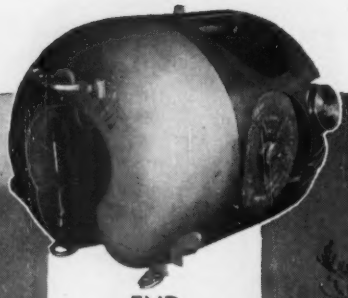
CIRCLE 103 ON READER SERVICE CARD 103



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The new Model K pull-type Spinner was designed especially for power cables, with a background of many years' experience in telephone cables. It has been adopted as standard by many electric utilities.

- Lashes three cables as large as 2" O.D. at one time.
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- Lashes with wire of any type or size.
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For descriptive information and application data please drop us a note.

CABLE SPINNING EQUIPMENT CO.

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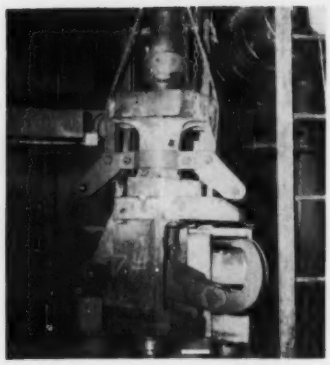


Bracket Handles Valves

E. L. KIMMELL, Maintenance Helper, Clinch River Plant, Appalachian Power Co, Cleveland, Va.

A lifting device built at the Clinch River Plant has simplified and standardized the removing and replacing of the bottom control valves on high-pressure turbines. With this device, time involved is cut by 50% and the hazards of handling the valves are considerably reduced.

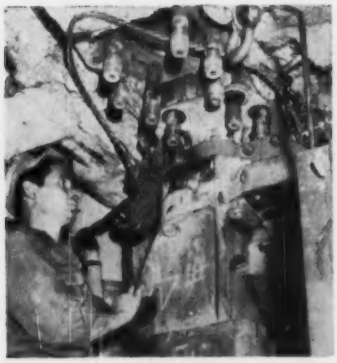
In the past it was necessary to resort to special and difficult rigging to lift or install the heavy valves. There were many variations in the method of doing the job, depending on the workmen assigned to it. There always was confusion about the hitching of cables and the use of come-alongs and jacks.

All of these difficulties and dangers now have been eliminated with the new device. It consists of a clamp and bracket that is bolted around the valve stand, just below the flange. Two

Tripod Lifts Bushings

M. I. OLKEN, Engineer,
V. P. RADER, Senior Engineer, Electrical Engineering Division, American Electric Power Service Corp, New York, N. Y.

A simplified method of removing high-voltage bushings where space is limited was found to be successful in tests at some of our newest stations. The new method uses a block and tackle supported



Safer and Faster

sets of fingers stick up from the clamp to rest against the flange. There is enough room below the flange to attach slings and come-along hooks to the cross bolts.

To use the device, the cable and chain hoist first are attached as illustrated. The valve is lifted from the fork-lift truck to a point about 4 ft from the turbine casing. Then the valve is held in place by the chain fall while two come-alongs (one on each side) are attached to some convenient and adequate support point on the turbine shell overhead. The other ends of the come-alongs are hooked to the lower lifting lugs on the bracket as illustrated.

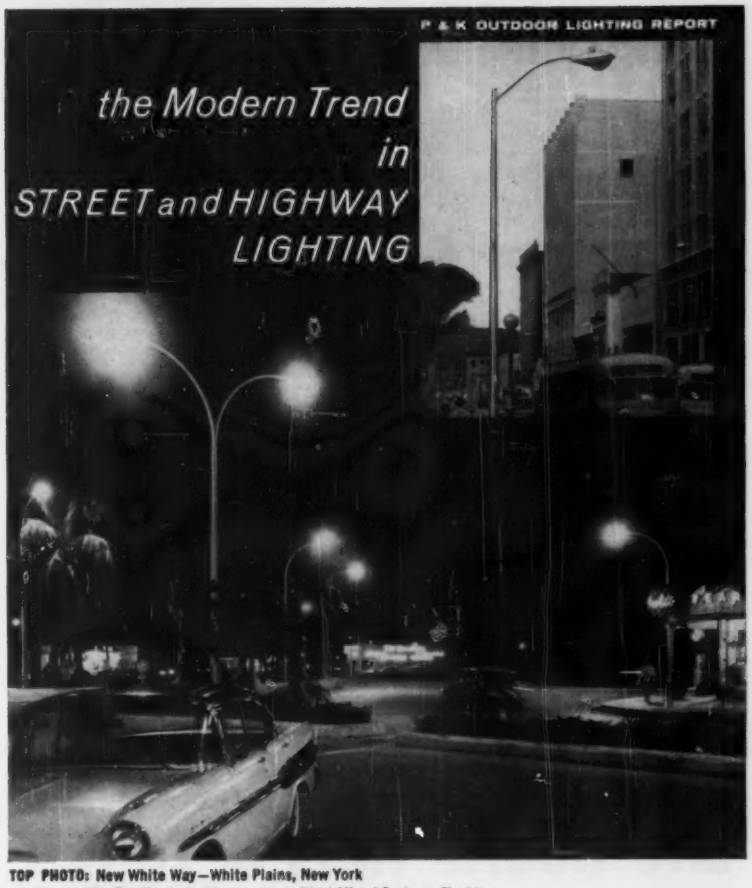
The valve stand then can be hoisted straight into place, spacers placed on the studs, and the nuts run up by hand. Whereas the former method took 2 man-hr to handle the turbine valve, use of the lifting device cuts the time to 1 man-hr. Cost of the clamping bracket was less than $50 for material and labor.

in Limited Space

from a large tripod with telescoping legs. The tripod is made by B. E. Wallace Products Co.

Where space is limited, the usual method of using a truck and boom for bushing removal may be rather awkward and in some cases, extremely hazardous. The advent of 138-kv ground-mounted

(*Continued on page* 106)



TOP PHOTO: New White Way—White Plains, New York
LOWER PHOTO: Traffic circle illumination—West Miami Springs, Florida

P&K ALL ALUMINUM

LIGHTING STANDARDS & DAVITS

More than just modern-looking, P&K street lighting standards are modern in total concept. Compare our use of functional design . . . no scrolls, no tie rods . . . instead a strong aluminum tapered elliptical arm – one piece for minimum inventory, fastest assembly and installation. Compare the P&K davit, truly the ultimate in functional design with a style as fresh as tomorrow. What's more, P&K is modern in the materials of construction: to the inherent strength and light weight of aluminum, P&K has engineered designs to meet every load requirement – from the conventional incandescent and mercury vapor luminaires to the new, larger and heavier models in both mercury vapor and fluorescent. And above all, P&K is modern in its elimination of maintenance problems. No painting required – ever. Even the salty sea air offers no hazard to the good looks of P&K standards.

For more information reserve your copy of the new Aluminum Lighting Standards catalog now. Ask for our helpful brochures ALS and BR-11.

P&K

PFAFF & KENDALL 84 FOUNDRY ST., NEWARK 5, N. J.

BRANCH SALES OFFICES: MIAMI, FLORIDA; BURLINGAME, CALIFORNIA
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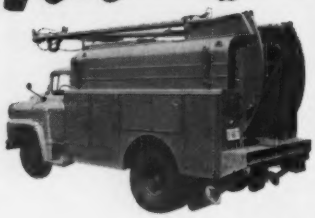
EXPORT REPRESENTATIVE: PHILIPS EXPORT CO., NEW YORK, N. Y.

CIRCLE 105 ON READER SERVICE CARD

Koenig ALL-STEEL UTILITY BODIES



LINE-CONSTRUCTION BODY

. . . available in 9' to 14'6" lengths with mechanical or hydraulic winch and derrick, or any other special or custom equipment desired. Compartments can be arranged to your specifications.

SERVICE BODIES

. . . for ½-, ¾-, and 1-ton chassis. Electrically welded into one unit with six waterproof compartments, recessed paddle handles keyed alike and fender skirt protected with die-formed rolled edges. Built for safe, dependable service . . . will outlast several chassis.

3-WAY DUMP BODIES

DUMP to the RIGHT, LEFT and REAR

All-steel welded bodies available in 8' to 11' lengths. The multistage telescopic hoist has a lifting capacity of 25,000 lbs. This is the ideal body for safe dumping under hazardous conditions . . . especially adaptable for windrowing and backfilling.

YOU CAN BE SURE OF QUALITY MATERIALS AND WORKMANSHIP WHEN YOU SPECIFY KOENIG PRODUCTS

Write today for literature, specific information and name of nearest distributor.

Koenig IRON WORKS, Inc.

P. O. BOX 7726C
HOUSTON, TEXAS

CIRCLE 46 ON READER SERVICE CARD

'Life Guard' Hats & Caps

The best in head protection for electrical/construction workers

Jackson's 'Life Guard' safety hats and caps safely resist over 20,000 volts, and they also provide impact resistance to more than satisfy federal requirements for safeguarding construction workers.

'Life Guard' safety caps have narrow brim around sides and back, visor in front. Injection molded plastic is strong yet flexible, has a soft comfortable feel. Caps may be ordered with attached welding helmets, goggles, and assorted face shields.

Standardize on this all-purpose safety hat for maximum head protection. Identify work categories by issuing these different hat colors: white, yellow, grey, and orange.

'Life Guard' safety hats offer neck protection with wide brim all around. The 'Life Guard' headgear is instantly adjustable in hat sizes, and its comfort keeps the hat where it does its job, on the worker's head. Chin straps and warm winterizers are available.

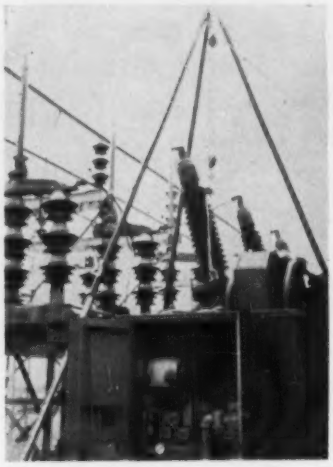
Jackson Products

AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

31739 Mound Road, Warren, Michigan

Sold by better welding supply and safety product dealers everywhere

Tripod Handles Bushings



TELESCOPING TRIPOD provides a quick means of removing bushings when clearances to switches and 138-kv buses are limited

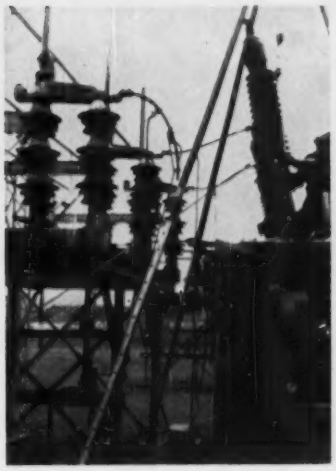
bus and the "breaker-and-a-half" scheme has increased the difficulties of breaker maintenance when bushing removal is required.

The procedure as tested at Kammer Plant is shown in the accompanying photos. In less than 3 min the tripod was erected and fully extended over the bushing. For additional ground support, the tripod legs were placed in mud-plates on the ground. The process of pulling the bushing from its tank and bringing it to the ground took less than 2 min.

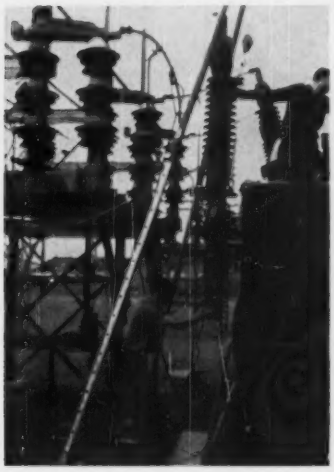
In this operation, two men pulled on the rope falls, another held a line secured at the flange to steady the bushing, and a fourth on top of the tank guided the bushing up and away from the tank. In a similar manner, the bushing was replaced in the tank in less than 2 min once the lines were secured around the bushing. Dismantling of the tripod took about 3 min.

Two bushings were removed to provide an effective test of both tripod and procedure. The middle-phase bushing was removed from a middle breaker and an end-phase bushing from a bus breaker. The closest clearances were encountered in removing the bus breaker bushing.

(*Continued from page* 105)



BUSHING IS GUIDED up and away from tank by one man while two others handle the rope falls and a fourth mans the guide rope



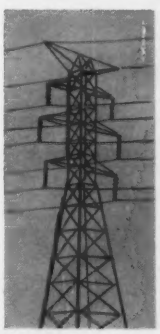
CAREFUL HANDLING continues while bushing is lowered to the ground. Removal of bushing takes 2 min; erection of tripod, 3 min

The tripod has a maximum height of 21 ft when fully extended, but the B. E. Wallace Products Co now has models available with a 24-ft height. All are rated at 1,000-lb capacity, adequate for the 500-lb 138-kw bushings removed in the test.

CIRCLE 62 ON READER SERVICE CARD

On Crossarm With Added Angle Attachment — *With Pole Bracket*

67½°-90° Angle Attachment and Pole Bracket are accessories.



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Please send complete catalog of S&R conductor stringing equipment.

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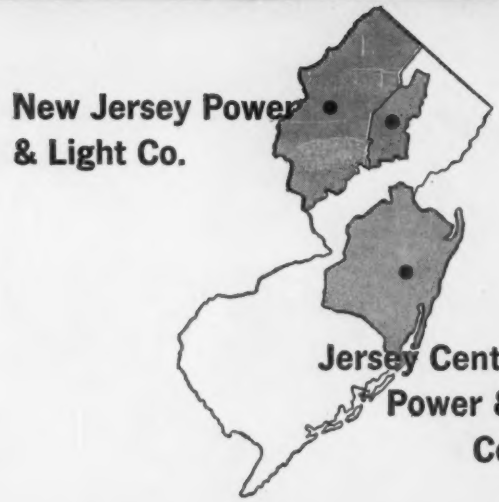
COMPANY_____

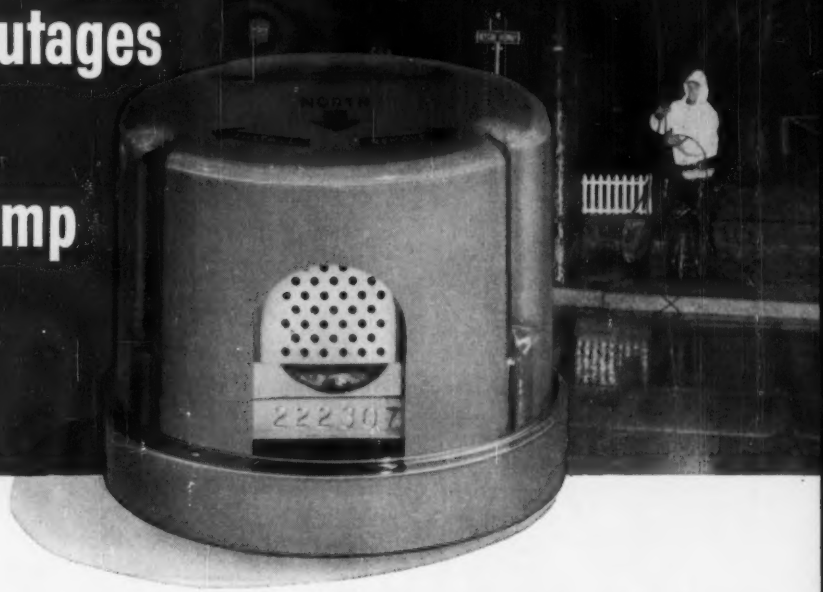
ADDRESS_____

CIRCLE 107 ON READER SERVICE CARD



Emergency crew working in driving rain to restore service in Asbury Park. Outages caused by series streetlighting wires snapping in high winds have now been eliminated by conversion to multiple individual control.

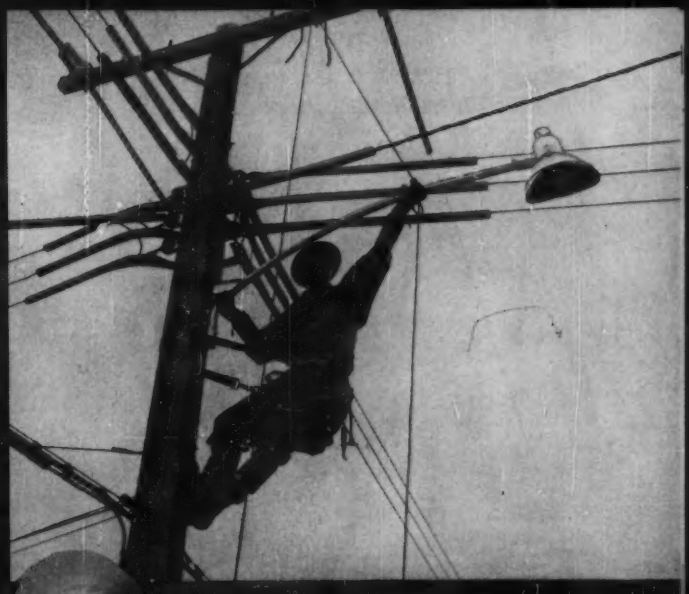
Two Progressive Utilities Reduce Storm Outages with F-P Individual-Lamp Controls



Conversion by Jersey Central Power & Light Co. and New Jersey Power & Light Co. from series to multiple individual photoelectric streetlight controls, many of them Fisher-Pierce Series 6600A units, has eliminated some tough problems brought on by severe weather. Since 1954 New Jersey has experienced a succession of hurricanes (that year there were three in six weeks) and unusually fierce winter storms, which caused series wires to snap in high winds and under the weight of ice. Other lines were being shorted by these broken wires, or had to be cut for safety when repairing the streetlight wires. The result was many service interruptions and plenty of headaches. Individual controls—and elimination of the series wire — provided the answer.

In 1957 these utilities embarked on a progressive relighting and conversion program that has reached completion in certain areas. Every street in Asbury Park, for example, conforms to IES lighting standards, and every lamp is individually controlled. Because poles have been cleared of several hot elements, pole work is simplified. And the danger of fires from high voltage leaks due to broken series wires — a particular problem where there is damp, salty air — has also been eliminated.

CIRCLE 108 ON READER SERVICE CARD



Down with the old... Up with the new...

New, brighter streetlight equipped with Fisher-Pierce Series 6600A control replaces series streetlight as part of JCP&L and NJP&L conversion program. Short time delay in the F-P control permits fast checking and effectively prevents false turn-off by lightning – no cases have been reported to these utilities. All streetlights in Asbury Park (below) are individually controlled.

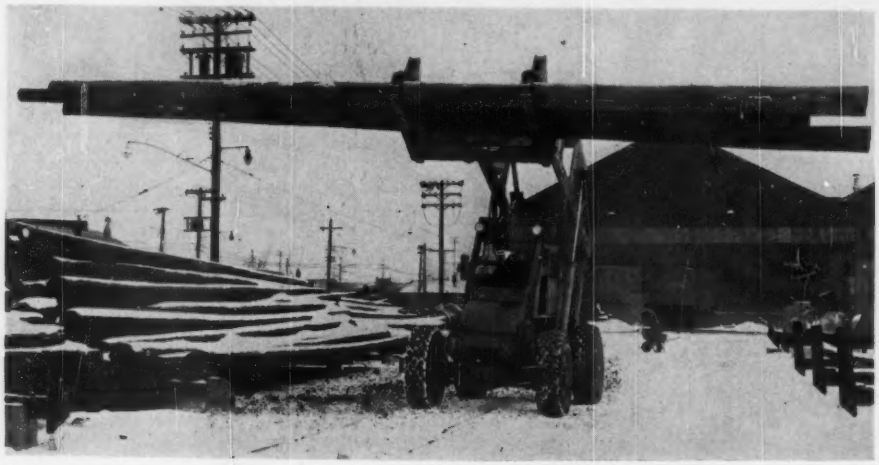
For complete design information and specifications on Series 6600A controls, write The Fisher-Pierce Co., 82 Pearl Street, So. Braintree 85, Massachusetts.

FP

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.



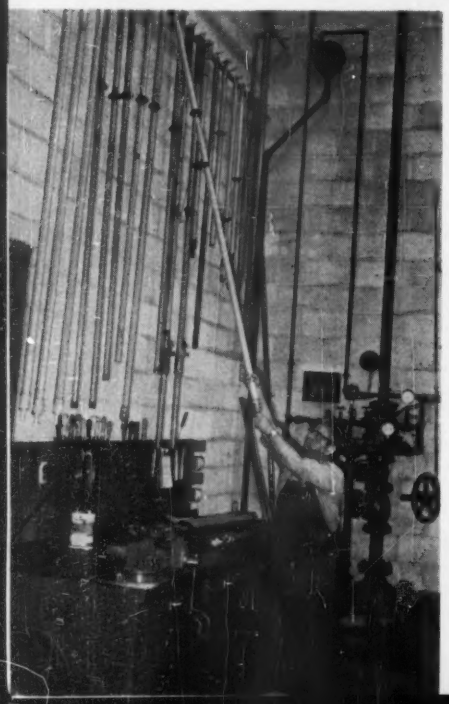
Loader Speeds Handling of Poles and Reels

Poles and reels are lifted and carried quickly and easily with a 10½-ton loader at the Brooklyn Garage and Warehouse of Cleveland Electric Illuminating Co. The loader offers more mobility and flexibility than the railroad crane and lift truck it replaced.

This $26,000 mechanical helpmate of the crew in CEI's Transportation and Supplies Dept is known as the Pettibone, Super 15, Cary-Lift Loader. It has a 15,000-lb lifting capacity, power shift transmission, and four-wheel power steering. Hydraulically-operated 66-in. long twin forks, which can be swung from left to right, eliminate much "jockeying for position" in the yard.

The loader is operated by one man from an enclosed, heated cab. It can pick up as many as five wood poles from a flatcar and lower them in yard racks. It also can pick up a cable reel in its log baler. Over-the-road speed of the loader is 30 mph.

CIRCLE 63 ON READER SERVICE CARD



Special Rack Dries Reconditioned Hot Sticks

A special drying rack has simplified the problem of drying reconditioned hot sticks in Oklahoma Gas & Electric Company's shops at their new service center. After varnish has been applied the sticks must dry thoroughly before handling. The practice followed in the past has been to stand them in a corner or hang them on a string. As the number of sticks handled increased, these methods created more clutter.

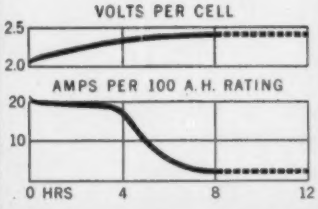
The new rack provides ample space for drying the number of sticks now being handled. It can be expanded easily if that becomes desirable. Long sticks can be hung on the rack by a man standing on the floor. A short step ladder is kept handy so that the rack can be reached easily with short sticks.

The new rack keeps sticks out of the way while they are drying and eliminates the possibility of smearing freshly varnished surfaces. This assures best possible condition of the stick when it goes back in service.

NEW CHRISTIE

SILICON BATTERY CHARGERS

Stepless charging from start to end.
Less gassing, **less** heat,
longer battery life!



- Fully Automatic Mag-Amp Control. No relays. No moving parts. No timer necessary. **Virtually maintenance free.**
- For Lead-Acid and Edison type batteries. 8 hour charging of batteries up to 720 A.H.

Get the Complete Story in the New Christie Catalog Write for Bulletin BC-60

CHRISTIE ELECTRIC CORP.
3414 West 67th Street
Los Angeles 43, California

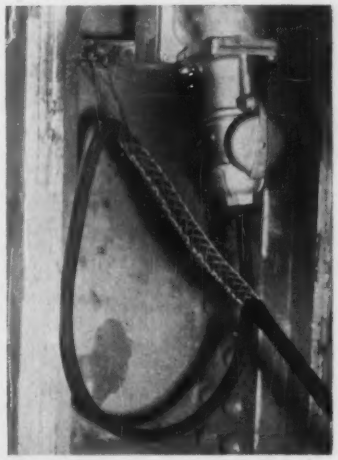
Proven Quality through 30 Years of Battery Charger Manufacturing

Prevent Removal Of Welding Cable Under Load

J. E. MAYNARD, Master Maintenance Man, Kyger Creek Plant, Ohio Valley Electric Corp, Gallipolis, Ohio

Cable grips on both ends of a welding machine cable will prevent the accidental removal of the plugs while the welding machine is being used. Removal of plugs on the 550-v cable while under load can produce an arc that will damage or destroy the receptacle, switch box and plug, and will endanger personnel in the area.

At a cost of $2 each, cable grips were installed on both ends of the cable. The grip at the plug end is attached to a hook near the receptacle; the other grip is fastened to an eye on the welding machine housing.



NO MORE DARK STREETS!

Save UP TO $50,000 PER YEAR WITH

UNBREAKABLE Fiberglass STREET LIGHT GLOBES

- ***Shatterproof***
- ***Lightweight***
- ***Weatherproof***

Over 10,000 in use by leading Utilities and Municipalities

Now...an unbreakable fiberglass street light globe that defies even the most vicious vandalism. These new Plastic Age globes answer the most rigid requirements for an outdoor light globe. *Excellent light transmission properties. Save replacement time—eliminate hazards* to pedestrians, automobiles and utility work crews. Weigh 1/10th as much as a glass globe. May be stacked one into the other *without* warehouse breakage.

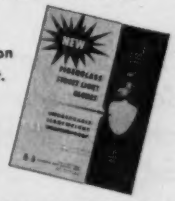
Available for all major types of luminaires.

NO BREAKAGE FROM BB'S, PELLETS, OR ROCKS

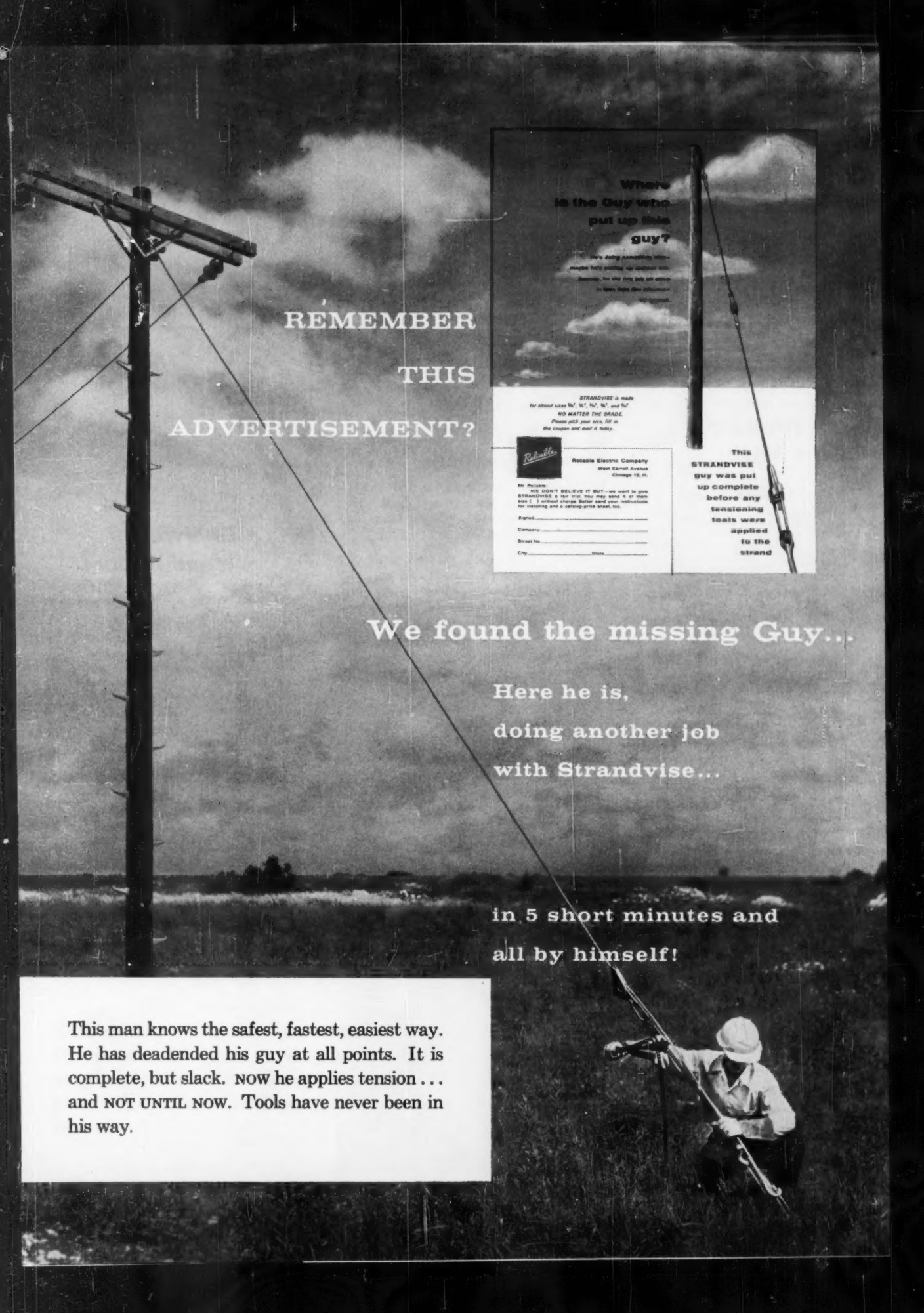
No penetration from rocks, BB's or pellets. Small arms fire will enter but not shatter. Chopped glass fibers at hole edges tend to reseal to prevent insect entry.

WRITE TODAY FOR DETAILS

Complete brochure and order information available on request.



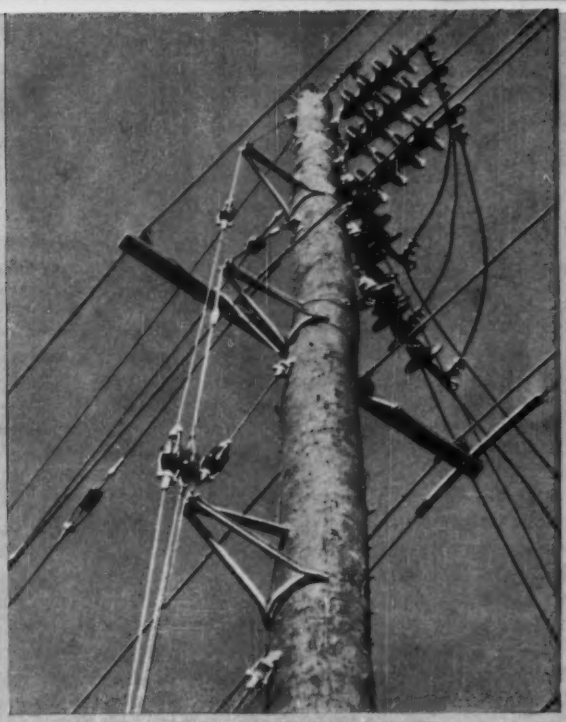
COMMERCIAL PRODUCTS DIVISION
PLASTIC AGE SALES, INC.
14300 DAVENPORT ROAD
MINT CANYON, CALIFORNIA


Where is the Guy who put up this guy?
STRANDVISE is made for strand sizes ⅜", ½", ⅝", ¾", and ⅞" NO MATTER THE GRADE. Please pick your size, fill in the coupon and mail it today.
Reliable
Reliable Electric Company
West Carroll Avenue
Chicago 12, Ill.
Mr. Reliable:
WE DON'T BELIEVE IT BUT - we want to give STRANDVISE a fair trial. You may send 4 of them size ( ) without charge. Better send your instructions for installing and a catalog-price sheet, too.
Signed
Company
Street No.
City
State
This STRANDVISE guy was put up complete before any tensioning tools were applied to the strand
REMEMBER
THIS
ADVERTISEMENT?
We found the missing Guy...
Here he is,
doing another job
with Strandvise...
in 5 short minutes and
all by himself!
This man knows the safest, fastest, easiest way. He has deadended his guy at all points. It is complete, but slack. NOW he applies tension . . . and NOT UNTIL NOW. Tools have never been in his way.

Head-guys and

down-guys

the Strandvise way

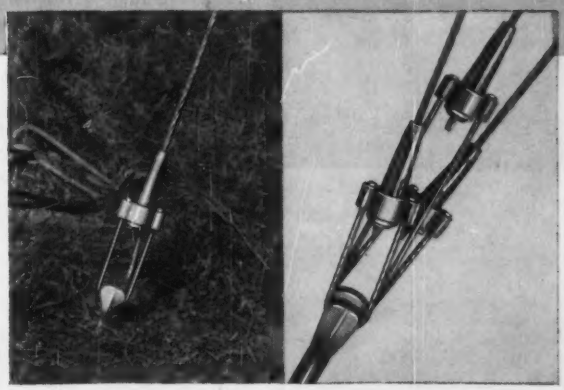


The fourteen Strandvises on these lines saved someone three to four $MH (man-hours).

take so little time, so little work . . . save you time-dollars!

More and more utilities are using Strandvise . . . the feed-through deadend that lets *one man* put up a guy in five short minutes. No tensioning tools are used until the guy is complete . . . just as easy for double or triple guys.

During more than 25 years of continuing production, it has never been reported that a Reliable deadend chuck let go a line.



Reliable

A Symbol of Integrity Since 1909

ELECTRIC COMPANY

11333 Addison Street • Franklin Park, Illinois

CIRCLE 113 ON READER SERVICE CARD

Flush Handle Eliminates Hazard

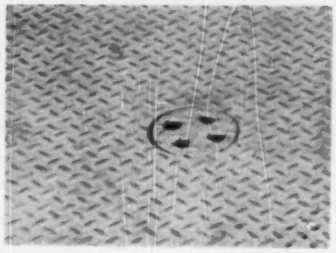
CLIFF MORROW, Plant Safety & Training Supervisor,
Southwestern Public Service Co, Amarillo, Texas

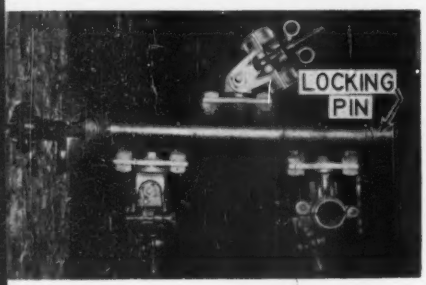
An ingenious telescoping arrangement that allows valve operating handles to drop down flush to the floor eliminates one problem that has been a "thorn in the side" to plant operators and safety men for years. A valve handle protruding upward through the floor in aisles or walkways represents a hazard that can result in painful injury and lost time.

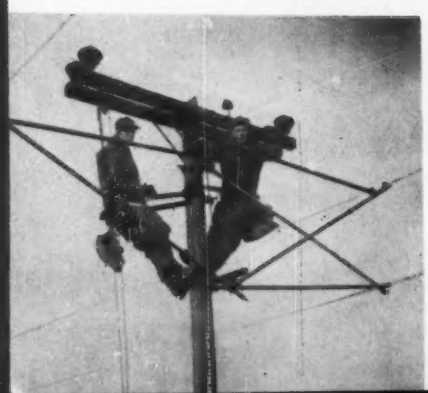
One solution would be complete removal of the valve handle, but this is impossible if frequent adjustment is necessary, as in the case of shaft seals on some turbines. The Moore County Plant of Southwestern Public Service Co has solved the problem with a telescoping handle arrangement that allows the handle down flush to the floor when not in use. This particular installation is in a steel plate but it could be used in other types of flooring.

To operate the valve, the hand wheel first is grasped by using the finger holes. The hand wheel then can be raised to a convenient height to open or close the valve. The telescoping arrangement in the handle consists of a square shaft which is attached to the hand wheel.

The lower half of the handle, which is attached to the valve stem, has a square hole in the upper end, into which the square shaft attached to the hand wheel extends several inches. This arrangement permits the hand wheel to be raised to be operated without becoming disengaged from the valve stem.







3-in-1 Saddle Makes Work Safer

J. R. BELLINGER, Transmission & Distribution Foreman, Ohio Power Co, Van Wert, Ohio

Two special saddles with pipe extensions each provide a mounting for three hot sticks to keep conductors in the clear for change-out work at the pole top. The saddles eliminate most of the congestion on the pole and thus contribute to safer working conditions. They also save at least 1 man-hr per job, based on two years of field use.

The special saddle consists of a regular saddle to which the pipe extension is bolted and sleeves that slide over the pipe. The extension was made by inserting a ¾ x 4-in. bolt into a 16-in. length of 1½-in. pipe and welding them together with 1½ in. of thread exposed.

Sleeves each are made from a 4½-in. length of 2-in. pipe, to which two ⅝-in. nuts are welded at a 2½-in. spacing. Bolted to these nuts is an assembly consisting of a wire tong saddle and clamp bolted to a ¼ x 1 x 4½-in. galvanized steel strap. Extensions and sleeves, assembled from scrap material, were made for less than $5 each.

Each pipe extension is tested for its capability of supporting 300 lb safely. However, the special saddles are used only for supporting conductors up to and including No. 2 copper. For heavier conductors a knee brace at the end of the extension would provide additional strength.

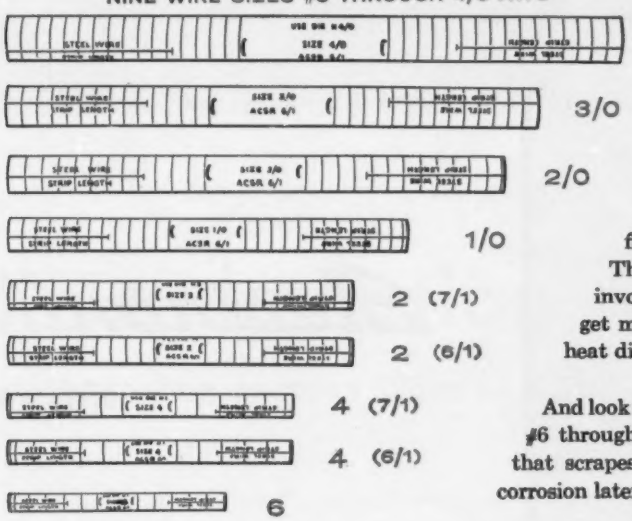
IN SHORT

(#4 ACTUAL SIZE)

AMP UTILI-TENSHUN

FOR SPLICING ACSR CONDUCTORS

NINE WIRE SIZES #6 THROUGH 4/0 AWG



Here's top notch reliability in a splice that is shorter by inches than most other types . . . made possible by the special factory installed steel core of the barrel which accommodates the center steel strand of ACSR cable.

This minimizes the length of rigid area in any run of cable—reduces the danger of cable breakage from flexing. Bell mouth prevents sharp-edged chafing. There's fewer crimps to make, less metal and less time involved . . . all working to lower your applied cost. You get maximum cross sectional crimp contact and exceilent heat dissipation.

And look at the plus features: Utili-Tenshun, in nine sizes from #6 through 4/0 AWG . . . preloaded with inhibitor compound that scrapes away oxide film when crimped and deters inner corrosion later . . . has clear marking on the barrel.

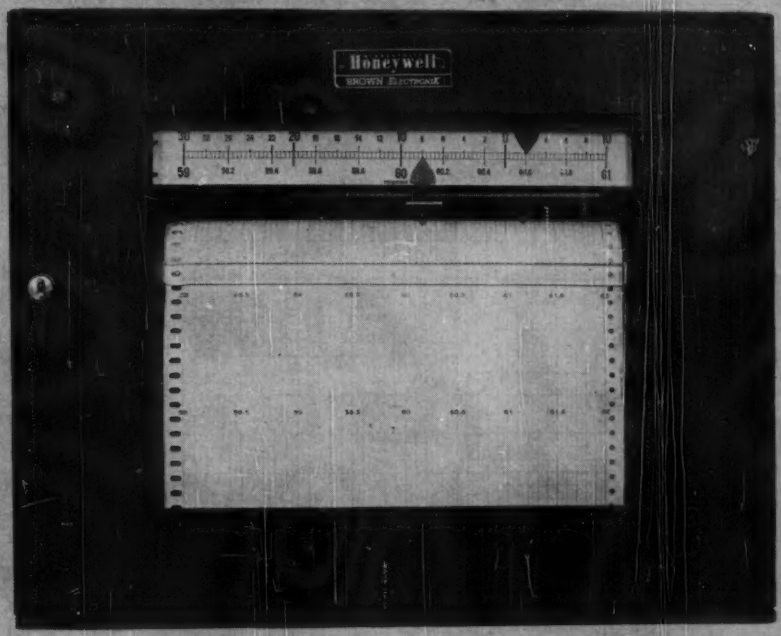
Utili-Tenshun Splice is the shorter surer way to reliability—and at lower applied cost. Write today for more information and free samples.

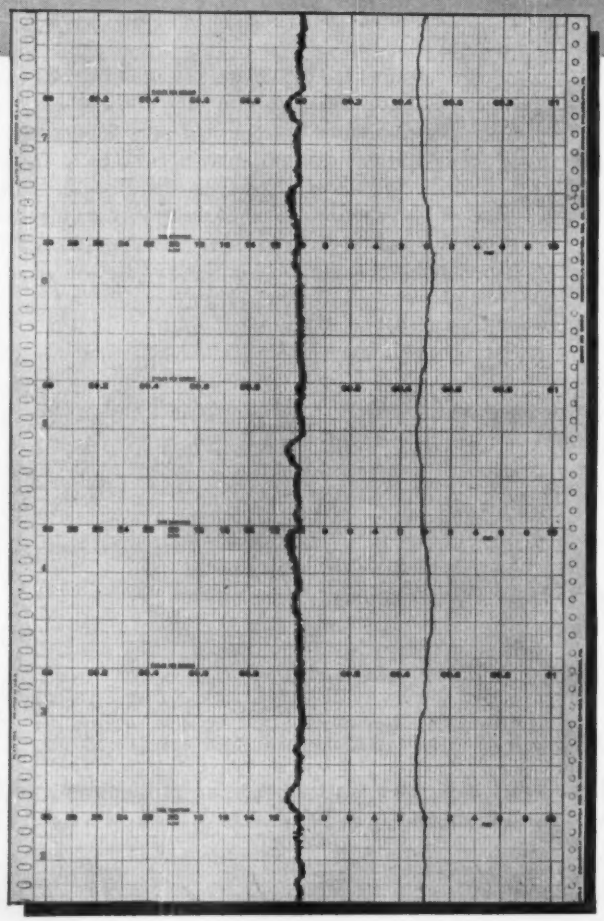
American Pamcor, Inc.

GENERAL OFFICES: 181 HILLCREST AVE., HAVERTOWN, PA.

Exclusive Distributor For AMP Products To The Utility Industry

ElectroniK **time deviation recorder has an accuracy of ¼ percent and sensitivity of ½ percent. Standard ranges are 10-0-10 and 30-0-10 seconds, on the full 10½" width of the calibrated chart.**



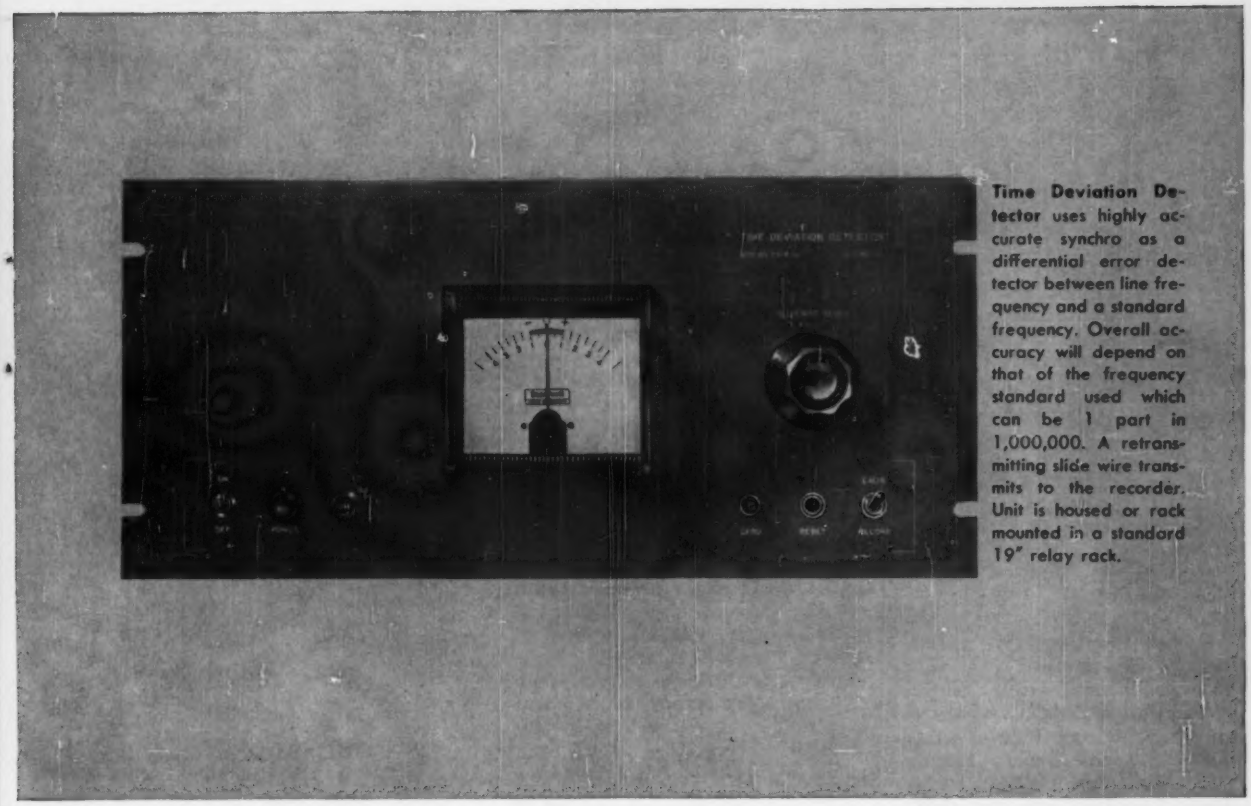


ElectroniK aids in

Record of frequency and time deviation on same chart. Full chart width is used for both calibrations.

75th YEAR

PIONEERING THE FUTURE



Time Deviation Detector uses highly accurate synchro as a differential error detector between line frequency and a standard frequency. Overall accuracy will depend on that of the frequency standard used which can be 1 part in 1,000,000. A retransmitting slide wire transmits to the recorder. Unit is housed or rack mounted in a standard 19" relay rack.

time deviation recorder

maintaining correct time in your generating system

The *ElectroniK* Time Deviation Recorder provides an indication and a continuous chart record of time error due to frequency changes on your electrical generating system. It detects the difference between your system frequency and a standard frequency. It integrates frequency deviation from standard (60 cycles on a 60 cycle system) and duration of this deviation to produce a direct reading chart in seconds of time, slow or fast.

Using the *ElectroniK* chart record as a guide, the operator or load dispatcher can easily make up lost time during off peak periods thereby reducing his time error to zero (correct time).

The instrument is available with automatic control features and fits nicely in Load-Frequency Control Systems to maintain correct time automatically.

Your nearby Honeywell field engineer can give you complete details on this and other instrumentation for central station use. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Phila. 44, Pa.

Honeywell

First in Control

SINCE 1885

CIRCLE 117 ON READER SERVICE CARD

MANUFACTURERS LITERATURE

To request literature, use code numbers indicated for each item when filling in Reader Service Card

CIRCUIT BREAKERS

LOADCENTERS . . . circuit breaker and fusible, plus small fusible devices and special application devices, with all items listed subject to discount Schedule U-1. 1960 Walker Speedfax catalog, 36 pages. I-T-E Circuit Breaker Co, Walker Div, Philadelphia, Pa. **(140)**

LOAD CENTER LINE . . . new 150 and 200-amp "Twin" circuit breaker load centers. Includes specifications on "Twin" load center line, from 2 to 40 circuits, 40 to 200 amp in flush, surface, and raintight enclosures. New 100-amp, 2-pole, plug-in circuit breakers, service entrance main enclosures and non-interchangeable plug-in breakers to meet NEC standards, section 240-25 (g). Bulletin GEA-7071, 16 pages. General Electric Co, Distribution Unit, Plainville, Tenn. **(141)**

CIRCUIT BREAKERS . . . rotary handle, for switchboards, control centers, panelboards, and enclosed circuit breakers, 15 through 800 amp, includes EF, F, J, and M-frame breakers. Bulletin 1425, eight pages. Federal Pacific Electric Co, General Offices, 50 Paris St., Newark 1, N. J. **(142)**

DISTRIBUTION

WIRE REELS . . . adjustable, in four mounting assemblies for truck beds, sides of truck bodies, and pipe rails. Illustrations of applications, ordering information. Also details on accessories and maintenance. Bulletin No. 60010-CM3, four pages. Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis. **(143)**

CONNECTORS . . . for integrated cable connection. Standard in-stock styles and special designs for special applications illustrated and identified. Bulletin B 77, four pages. Joy Mfg Co, 1201 Macklind, St. Louis, Mo. **(144)**

POWER FUSE RATINGS . . . 50/60-cycle short-circuit, interrupting. Lists interrupting ratings in both amperes (rms asymmetrical) and kva (symmetrical, three-phase) for transmission and distribution systems fuses from 2.4 to 138 kv, and for metalclad switchgear fuses. Ratings given with and without mufflers, for indoor and outdoor holders, and for solid-material and liquid fuses, based on AIEE specifications. Data Bulletin 205, 6 pages. S&C Electric Co, 4435 N. Ravenswood Ave, Chicago 40, Ill. **(145)**

CAPACITORS . . . technical summary includes detailed analysis of components of EUC capacitors, dielectric table, graphs of temperature characteristics, table of functions, series capacitance and temperature conversion charts, and other details in graphic form. Catalog, 78 pages. Electrical Utilities Co, La Salle, Ill. **(146)**

HEAVY DUTY CLAMPS . . . all-aluminum. Multi-bolt fittings designed for aluminum-aluminum and aluminum-copper conductors hot or cold—and to meet Class A requirement of EEI Tentative Specification 59-70. Data folder No. 6003, four pages. Jasper Blackburn Corp, 1525 Woodson Rd, St. Louis 14, Mo. **(147)**

HOUSINGS . . . Adelet, explosion-proof and weather-proof, of cast aluminum. Design information, detailed drawings, photographs and dimension charts for complete line. Also special explosion-proof housings and fittings. Section on explosion-proof and dust-tight housings with glass windows for instruments and meters. Bulletin No. 160, 16 pages. Adelet Mfg Co, 14300 Lorain Ave, Cleveland 11, Ohio. **(148)**

CAPACITORS . . . Isokraft "50" and pole-type equipment. Detailed data on new, smaller 50-kvar units, graphs, construction features for single-row, three-segment and twin-cluster pole-type equipments. Bulletin GEA-7061, 16 pages. General Electric Co, Schenectady 5, N. Y. **(149)**

EARTH HANDLING

RIPPERS . . . hydraulically-operated, rear-mounted for Caterpiller tractors D9, D8, D6, and D4 and for No. 955 Traxcavator. Gives construction details, describes operation for each model. Brochure, Form 33557, eight pages. Caterpillar Tractor Co, Advertising Division, Peoria, Ill. **(150)**

ROCKMOVING . . . Lorain 820A model, equipped as 2-yd shovel or as a crane, dragline, clamshell or hoe. "Shear-Ball" turntable connection highlighted, with air controls and new 10-yr warranty. Bulletin 820A. Form No. 36753-0, 12 pages. Thew Shovel Co, Adv Dept, Lorain, Ohio. **(151)**

TRACTOR SHOVELS . . . six models of "Michigan" line, with general specifications of each, also on the power train, hydraulic system, bonus buckets (ranging from 1 to 2¾-yd capacity) and overall engineering features. CMD Bulletin 3000, Construction Machinery Div, Clark Engineering Co, Pipestone Plant, Benton Harbor, Mich. **(152)**

EARTHMOVING . . . equipment —complete line of Caterpillar construction machinery and diesel engines, auxiliary equipment. Specifications table of engine models, illustrations of each set in line. Form D942, 20 pages. Caterpillar Tractor Co, Advertising Division, Peoria, Ill. **(153)**

INSTRUMENTS

THERMOCOUPLE ASSEMBLIES . . . 100 for general-purpose and special use, with specifications, new prices. Separate section on selection information. Catalog G100-1, 40 pages. Minneapolis-Honeywell Regulator Co, Industrial Division, Wayne & Windrim Aves, Philadelphia 44, Pa. **(154)**

(More Literature on page 122)

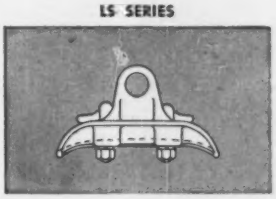
8 TIMES ACROSS THE CONTINENT

SINCE 1954, Bethea Company has made and shipped enough aluminum alloy suspension clamps to string over 21,500 miles of three phase, high voltage transmission line, using conductors that average 795,000 CM—enough to stretch across the continent eight times with no dead ends.

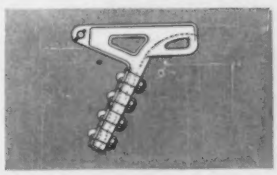
Bethea suspension clamps did—and are doing—the job. Bethea quality is consistently high. Bethea's rated ultimate strengths are well above the industry's average, yet, cost no more.

Write for catalog, samples and Pittsburgh Testing Laboratory Data

LS SERIES



ADE SERIES



QUALITY CABLE FITTINGS

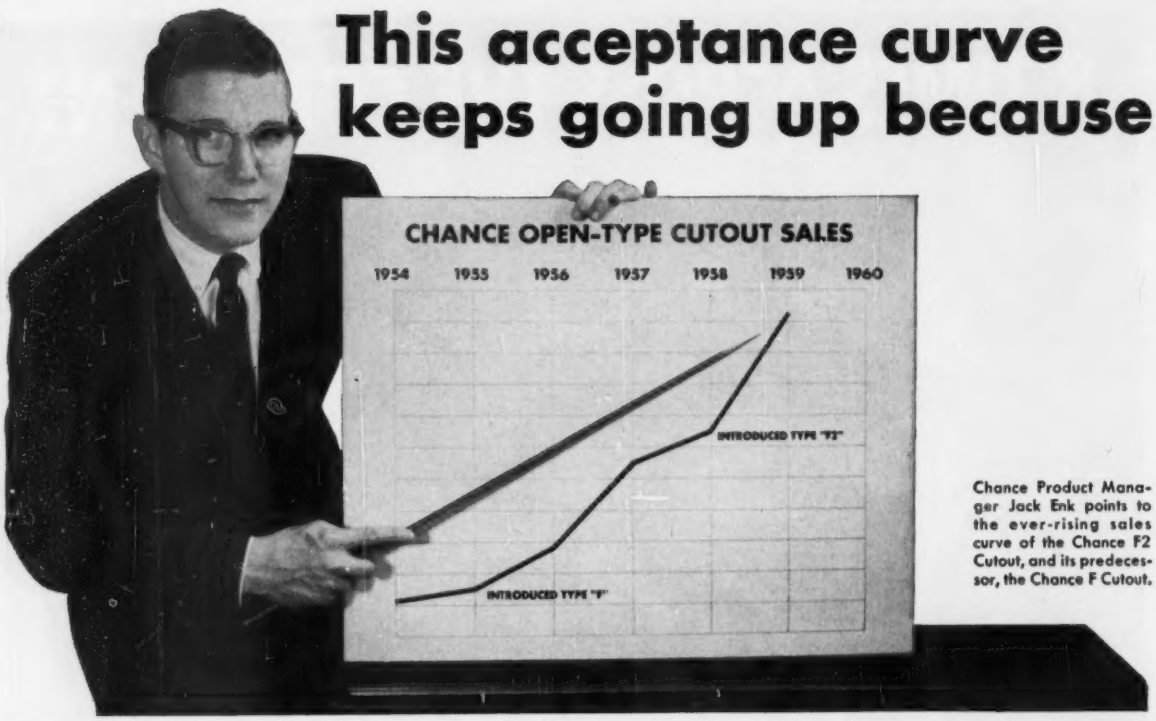
1950 1960 10th YEAR OF SERVICE

A BETTER WAY FROM . . .

Bethea COMPANY, INC.

P. O. BOX 1407 — BIRMINGHAM, ALABAMA

This acceptance curve keeps going up because..



Chance Product Manager Jack Enk points to the ever-rising sales curve of the Chance F2 Cutout, and its predecessor, the Chance F Cutout.

Product acceptance to help you buy with confidence

More and more Chance F2 Cutouts appear on power lines across the country every day. Utilities are buying these cutouts because they have proven to themselves that the F2 will protect their systems from *any* fault—HIGH, MEDIUM, or LOW (and points between). They also know that the F2 will provide the higher interrupting capacities tomorrow's systems may require.

44% of these major utilities accept and use the F2

Here Are Net Incomes for 144 Operating Electric Utilities*

Utilities from coast-to-coast, impressed with the ruggedness and full range effectiveness of the F2, have written it into their standards. These utilities are sold on the F2's ability to protect their systems against high, medium or low fault currents. Some of the utilities on this list published in *Electrical World* have more than 10,000 Chance cutouts in service. That's real product acceptance!

You can buy F2 Cutouts with confidence, sure that you're getting these advanced features so important for the protection you need:

- EXPENDABLE CAP assures wide-range operation on *any* fault. A small disc in the cap is ripped off on high fault currents, permitting the double-venting required to hold shock and strain to a minimum. On low and medium faults, the disc stays in place. By keeping the gases under the cap, the F2 single-vents to give protection against these lower faults.
- FUSE LINK EJECTOR makes doubly sure the cutout operates on low fault currents. Teamed with a small-bore fusetube, it assures low fault current interruption. Vitally important to load-break operation.
- POSITIVE LATCH holds fuseholder with a "bulldog grip"... keeps the cutout from opening under vibration or impact. Even if the fuselink is not installed tightly (or slips or stretches after installation), the fuseholder will not drop out. The latch cannot be welded shut because it is not a primary current-carrying element.
- ALL-BRONZE SLEET HOODS at both ends completely protect vital contact areas under all weather conditions. These all-bronze sleet hoods, and extensive use of copper alloy in the F2, guarantee trouble-free, peak performance, even in the most contaminated atmosphere.

The F2, in voltages of 5.2, 7.8, 15 and 27 KV, and in 100 and 200 ampere ratings with interrupting capacities as high as 12,000 amps, are available from local stocks.

CHANCE F2 CUTOUTS ARE ALSO AVAILABLE IN COMBINATION WITH LIGHTNING ARRESTERS

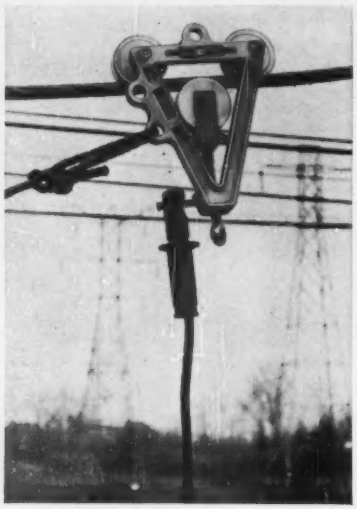
A. B. CHANCE CO.

CENTRALIA, MISSOURI

(A. B. Chance Company of Canada, Ltd., Toronto)

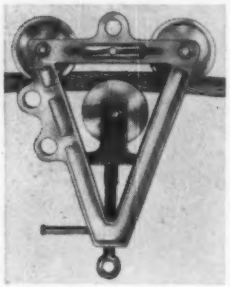
.....CHANCE F2 Cutout users
get positive interruption
at ANY fault current
LOW
FAULT CURRENT* INTERRUPTED
VOLTAGE
POWER FACTOR
115 15 KV 10%
200 14.4 KV 50%
400 14.4 KV 40%
600 14.4 KV 30%
800 14.4 KV 24%
MEDIUM
2300 13.6 KV 7%
4220 14.1 KV 19%
4380 13.6 KV 7%
4560 13.6 KV 7%
HIGH
8400 13.6 KV 7%
8630 14.1 KV 13%
These excerpts ▸
from a typical test record
show what you can expect
from a 15 KV F2 Cutout.
*Amperes RMS Asymmetrical

for Safe WIRE STRINGING



Bashlin's precision built

TRAVELING GROUND



No. 795 Close-up view of the new Bashlin Traveling Ground for Safe Wire Stringing.

Here are features of the Traveling Ground you will recognize as essential for Safe Wire Stringing. 1. Positive ground. 2. Light weight. 3. Eye for hotstick pickup. 4. Bronze oiled bushings. 5. Brush pickup with shunts to common ground. 6. Brass shoulder bolt axle. 7. Adjusts for conductors to and including 795,000 cm. ACSR. 8. All parts replaceable. 9. Shouldered pin to attach ground clamp. 10. Operates in either vertical or horizontal position. 11. Can be installed without threading through. 12. A Heli-Coil thread is used in the frame.

Distributors in Strategic Areas in U.S.A.

EXPORT: Copperweld Steel International Co. IN CANADA: A. B. Chance Co. of Canada Ltd., Toronto

Write for your copy of supplement to Catalog No. 356 giving complete details.

W. M. BASHLIN CO.
GROVE CITY, PA.

More Literature

(Continued from page 118)

TELEMETERING . . . metameter telemeters with principles of operation, application to various measurands, and electrical quantities illustrated. Computer control, pump control, remote control, selective calling, and Metaphone also covered. Bulletin M1715, 52 pages. Bristol Co, Waterbury 20, Conn. **(155)**

RECORDER . . . round-chart, Type HR, single-pen, measures variables with accuracy ± 0.25%, provides sufficient torque to operate variety of control devices such as switches and slidewires. Features high degree of component interchangeability. Bulletin GEZ-2969, four pages. General Electric Co, Schenectady 5, N. Y. **(156)**

LABORATORY INSTRUMENTS . . . specifications, application information and prices on seven categories, with illustrations. Folder E(6), 12 pages. Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. **(157)**

INSULATION

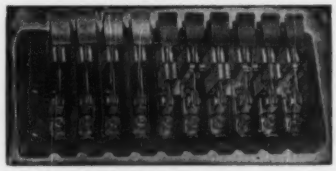
INSULATING VARNISH . . . the Isonel 31 modified-polyester for Class F, B, or A equipment. Applications to various types and sizes of motors, transformers and generators illustrated. Graphs show use on armatures, field coils. Bulletin Form No. SV-116, six pages. Schenectady Varnish Co, Inc, Schenectady 1, N. Y. **(158)**

EPOXY RESINS . . . specific applications to equipment such as stators, armatures, field coils and transformers. Booklet, 16 pages. John C. Dolph Co, Monmouth Junction, N. J. **(159)**

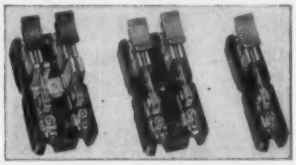
MICA PRODUCTS . . . technical information on mica hard plates, flexibles and flexible combinations, micapaper rolls, sheets and tapes, and fabricated parts made to specifications. Section on natural mica, types and processing. Catalog No. 26, 24 pages. Insulation Mfg Corp; 565 W Washington Blvd, Chicago 6, Ill. **(160)**

Make sure your TEST SWITCHES have the exclusive STATES features

- New Safety Grip Handle assures safer, easier gripping
- No live parts extend beyond base.
- Maximum pressure at jaw contacts.
- Large Selection of pole arrangements.
- Nickel corrision-resisting finish insures good contact, attractive appearance.



"SMK" TEST BLOCKS. Solid base type. Over 2,000 combinations of pole arrangements.



UNIT TYPE TEST BLOCKS
Wide variety of elements

THE STATES COMPANY
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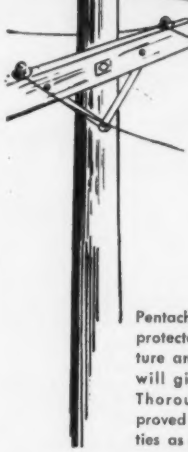
Haley's



CEDAR POLES • FIR CROSS ARMS

Pentachlorophenal Treated—protected against decay, moisture and insect damage, and will give long service life. Thoroughly tested and approved by leading public utilities as standard construction.

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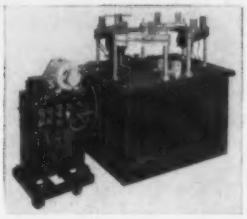
DO YOU HAVE TROUBLE getting sufficient current when testing CURRENT TRANSFORMERS ?

The States Design helps get more current **at the test point**—offers smooth, quick adjustment of current to full capacity of Form "CTT" outfits which are made in 1000, 2500, 5000, 6000 and 10,000 ampere capacities.



Portable Type Form "CTT" Loading Outfit. Contactor provides quick connection of standard transformer and transformer under test.

THE STATES COMPANY
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BRANSON'S **NEW**

SONOGEN® LGT-40

half-gallon Ultrasonic Cleaner

Self-contained, rugged, transistorized, temperature-stabilized. All stainless steel. Removable tank. 120W 110VAC input — 40W (80W peak) RF output. 14" x 7" x 13" overall height. Nationwide factory-trained service organization. Ask for Bulletin S-600.

Since 1946
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CIRCLE 50 ON READER SERVICE CARD

MOTORS & CONTROLS

APPLICATION GUIDE . . . for 1/20 to 400-hp motors, polyphase, single-phase, and dc. Selection charts, fully illustrated. Bulletin 270 B, 16 pages. Century Electric Co, 1806 Pine St, St. Louis 3, Mo. **(161)**

MOTOR CONTROL CENTERS . . . Plan-Pak I features modular draw-out uni-cell motor control center; Plan-Pak II, the modular fixed mounted uni-cell motor control center; and Plan-Pak III, the economy panel mounted motor control. All designs can be combined or matched at will. Fractional size starter ratings offered. Illustrated construction details, typical layouts, methods of figuring combinations, and suggested specifications. Bulletin SPM-1-1159, 16 pages. Automatic Control Co, St. Paul 4, Minn. **(162)**

MOTOR SELECTOR . . . ac motors from 1/40 to 300 hp. Standard motors in various voltages, speeds, and enclosures; also designs for variety of special applications which include cranes, hoists, elevators, machine tools, etc. Bulletin L-1661A, eight pages. Howell Electric Motors Co, Howell, Mich. **(163)**

FLEXIBLE COUPLINGS . . . including double-flexing, full-floating shaft, semi-floating shaft, and heavy radial load couplings. Misalignment described, photographs of couplings and installations, diagrams and tables for each type coupling. Loads are classified in new way and various types of couplings grouped for easier selection in this modernized version of Catalog 51 and 51-A. Many tables in previous catalogs extended to include new larger sizes and special couplings; miniature coupling line included. Engineering Catalog 60, 50 pages. Thomas Flexible Coupling Co, Warren, Pa. **(164)**

INDUCTION MOTORS . . . frame sizes 585 to 589, drip-proof to 400 hp, enclosed to 350 hp. Construction detailed includes ventilation of drip-proof motors and other modifications. Bulletin PB 6000-9, eight pages. Elliott Co, Crocker-Wheeler Plant, Jeannette, Pa. **(165)**

(More Literature on page 124)

ARMY and NAVY Also Use JAQUES Hydraulic EARTH AUGERS

**Pole-setting attachment optional.*

ARMY REPORT ON JAQUES KJ-254**

"There was a performance test on Pilot Model (Jaques Earth Auger), Model KJ-254, built by Texoma Enterprises, Inc. This test performed in accordance with Military Specification Mil-A-516B, paragraph 3.9 through 3.9.2.

"This test was performed in sandy, gravelly, red clay, hard and dry to blue silty clay at bottom of hole. Average time per hole for 25 consecutive holes was 78 seconds. Average depth of holes was 67.2 inches. Machine functioned at normal temperature."

***JAQUES newly developed Model TJ-254 is 2½-TIMES FASTER than Model KJ-254!*

Some of 29 JAQUES TJ-254's NAVY bought.

WHY BUY JAQUES?

1. JAQUES Augers have finger-tip, feather-touch controls . . . only 3 primary adjustments for easy, simple operation . . . Mount on standard trucks . . .
2. JAQUES drill holes up to 60" diameter . . . up to 25' deep in toughest soil . . . even in rock . . . FASTER, CHEAPER . . .
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4. JAQUES dig holes up to 45° angle, either side of truck . . . Patented pressure control takes strain off all parts when rock drilling . . .
5. FIRST Jaques built 29 years ago is STILL IN OPERATION!

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EXOMA ENTERPRISES, Inc.
Manufacturers of JAQUES Earth Augers
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☐ Send me FREE detailed literature.
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LUMATROL® MARK I !

If highest reliability at lowest cost is your most important requirement in automatic street light control... *this is the baby that will do the job!*

Write for Complete Specifications
MICRO BALANCING, INC., Garden City Park, New York
In Canada: J. R. Kearney Corp., Box 270, Guelph, Ontario

More Literature

(Continued from page 123)

COUPLING . . . Kinatrol all-electric adjustable speed drive featuring eddy-current-coupling principle. Data on this principle, torque capabilities, regulation and operation of entire packaged drive which includes main drive unit, control enclosure and operator's control. Charts on drive unit dimensions, rating and data. Bulletin GEA-6885, 12 pages. General Electric Co, Schenectady 5, N. Y. **(166)**

SPEED REDUCERS . . . Torque-Arm line now includes reducers built for up to 170 hp, with output speeds from 10 to 400 rpm, single and double-reduction series, with 5:1, 15:1, and 25:1 ratios. Standard accessories include overload release and built-in backstop, plus heat exchanger for largest sizes. Construction details, dimensions, prices and installation information given in sections illustrated with photographs and engineering drawings. Bulletin A692, 60 pages. Dodge Mfg Corp, Mishawaka, Ind. **(167)**

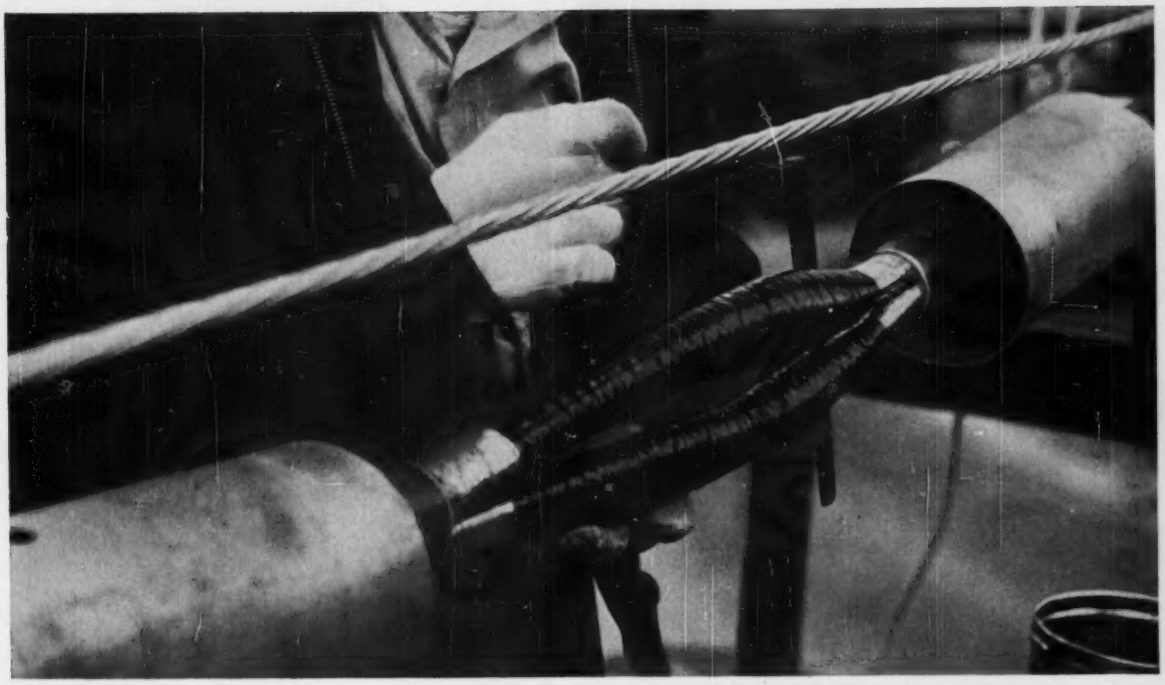
POWER STATIONS

CENTRIFUGAL FANS . . . all-purpose, series 3000, with flat, backwardly inclined blading. Applications and key components described and illustrated. Tabular performance data and dimensions for AMCA Class 1, 2, and 3 fans comprise major portion of this catalog No. 1120-1, 78 pages. Westinghouse Sturtevant Divisions, 300 Redville St., Hyde Park 36, Mass. **(168)**

RIGID PVC CONDUIT . . . test results, specifications information, installation instruction, corrosion resistant charts on rigid polyvinyl chloride electrical conduit. Catalog, 20 pages. Kraloy Plastic Co, Inc, Electrical Conduit Div, 402 W Central Ave, Santa Ana, Calif. **(169)**

CHECK VALVES . . . one-piece, cast steel tilting disk, designed for all-welded conventional and nuclear piping systems in 900, 1,500, and

(*Continued on page* 128)



RUGGED YEARS AHEAD . . .

that's why the job demands

SLIPKNOT

Overhead or underground, every splice in a distribution line must be final, safe and *permanent.* SLIPKNOT PLASTIC ELECTRICAL TAPE, 7- or 10-mils thick, *handles easily, conforms readily,* and *snugs* and *stays down.* That's why it's found in the hands of the country's most experienced linemen — and *in all the best splices everywhere.*

With adhesive permanently anchored to vinyl base, with controlled tension for proper stretch without dangerous thinning — with absolute conformity in mile after perfect mile — no wonder SLIPKNOT is the specified plastic tape.

Try a roll today — with our compliments.

TAPES BY
SOLD ONLY THRU RECOGNIZED DISTRIBUTORS
PLYMOUTH RUBBER COMPANY, INC.

Samples for testing, with complete specification data, available on request. Please specify 7-mil or 10-mil. Write Division U on your business letterhead.

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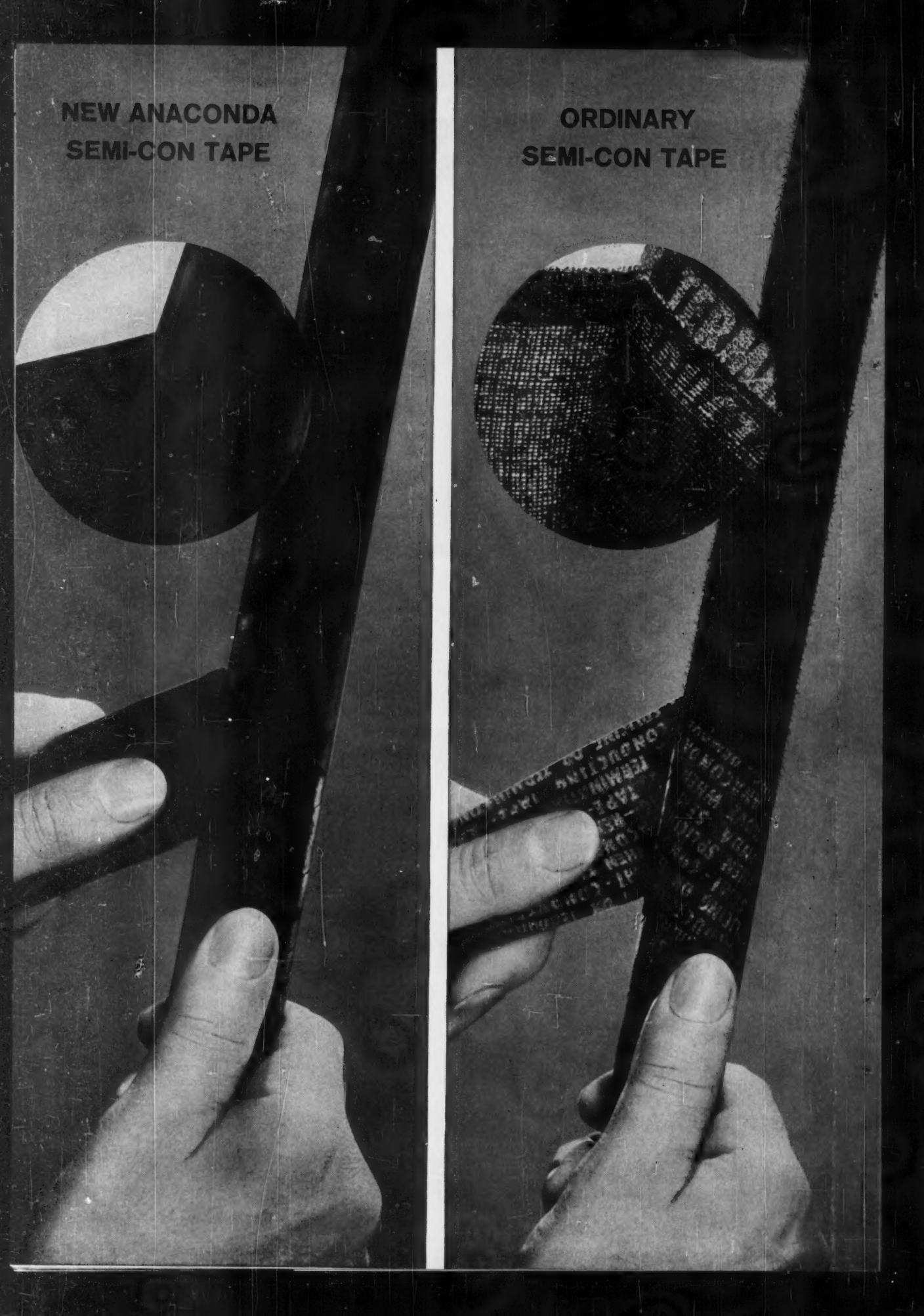
QUALITY SINCE 1896 *Makers of* SLIPKNOT FRICTION TAPE — *most widely used in the world* CANTON, MASSACHUSETTS


NEW ANACONDA
SEMI-CON TAPE
ORDINARY
SEMI-CON TAPE

NOW YOU CAN GET SAFER, FASTER, MORE RELIABLE JOINTS AND TERMINATIONS ON HIGH-VOLTAGE CABLE

Anaconda Durasheath has a new clean-stripping, semi-conducting tape

PROBLEM: To make a sound, safe, high-voltage splice, every last speck of semi-conducting tape material must be removed from the insulation . . . if traces remain, chances are the joint will eventually fail. But—this important step requires tedious scraping and buffing.

SOLUTION: The new Anaconda-developed *clean*-stripping, semi-con tape, which is an exclusive feature of Durasheath Cable. The photos (left) were taken immediately after semi-con tapes were stripped off the insulation. It takes much longer to get other cable insulation surfaces as clean. That's why this exclusive feature makes splicing a great deal easier.

The planned research and production program which brings you this outstanding cable development is also responsible for the equally important developments in Butyl rubber insulation compounding and extruding—which have produced the best possible balanced design and construction in high-voltage rubber-insulated cable obtainable today—Anaconda Durasheath.

For additional, more technical information about Anaconda Durasheath, write for Anaconda Bulletins, DM-5903, covering Durasheath High-Voltage Cable, and DM's-5566, -5720 and -5735, dealing with the splicing and terminating of Durasheath Cable. Contact your nearest Anaconda Wire & Cable Company district office, or write to 25 Broadway, New York 4, N. Y.

60239

ASK THE MAN FROM

ANACONDA®

FOR DURASHEATH® CABLE

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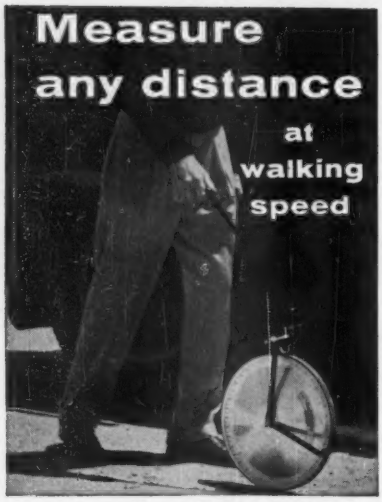

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More Literature

(Continued from page 124)

2,500-lb pressure classes and sizes from 6 to 20 in. Includes ratings, flow index table, curves, test results and valve material specifications. Catalog 14-Y, 12 pages. Edward Valves, East Chicago, Ind. **(170)**

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INDUSTRIAL HOSE . . . 35 types of rubber hose described in application and construction. Data on size, weight, ply working pressure, etc, provided in chart form, with two pages on hose fittings. Catalog, Form 1059, 24 pages. Mercer Rubber Co, Hamilton Square, N. J. **(173)**

SUBSTATIONS

SUBSTATIONS . . . mobile, up to 20 Mva, 115 kv, and mobile transformers up to 40 Mva, 138 kv. New product features, application information, illustrations, tables. Specifications include approximate weights and estimated net prices. Bulletin GEA-4415C, 24 pages. General Electric Co, Schenectady 5, N. Y. **(174)**

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UNIT SUBSTATION . . . articulated; workbook for low-voltage, secondary distribution systems. Load centers and substations for both indoor and outdoor applications. Specifications provided for incoming supply sections, transformer sections and outgoing feeder assemblies, both indoor and outdoor. Bulletin No. PSG-6001, 24 pages. Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa. **(176)**

APPARATUS BUSHINGS . . . for distribution and power transformer, circuit breaker and special purpose applications. Features paper-oil condenser type; dry type, assembled; wall, floor and roof bushings and bushings for special applications. Bulletin No. 546, 28 pages. Lapp Insulator Co, Inc, Le Roy, N. Y. **(177)**

TRANSFORMERS

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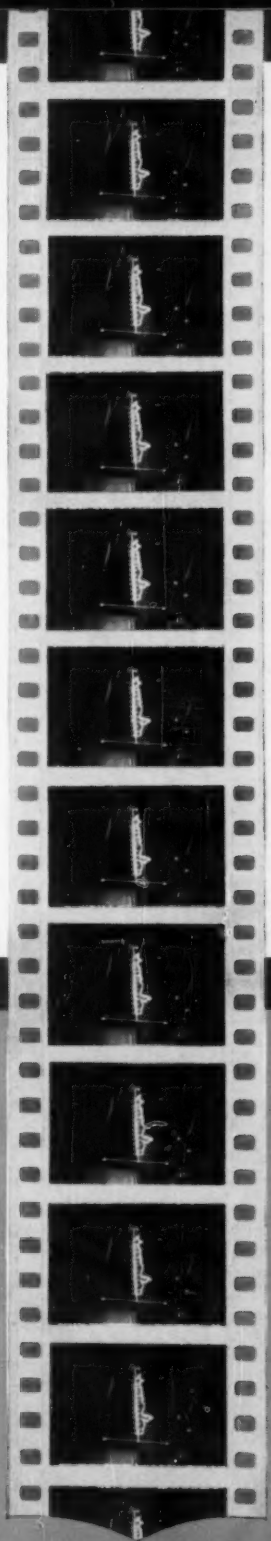

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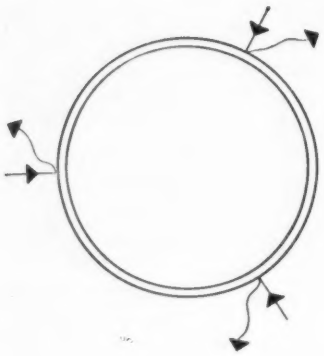

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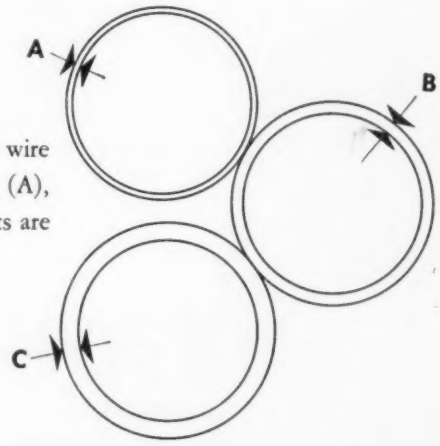
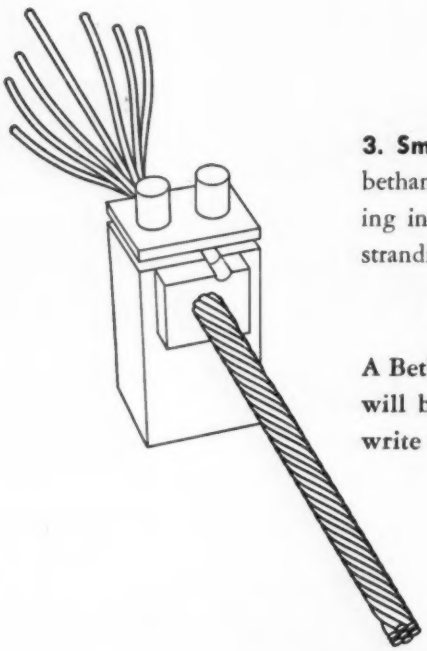


2. A choice of three coating weights Bethlehem ACSR core wire is available in three weights of bethanized coatings: standard (A), heavy (B), and extra-heavy (C). All three of these coating weights are furnished in sizes from 0.1878-in. to 0.0525-in.



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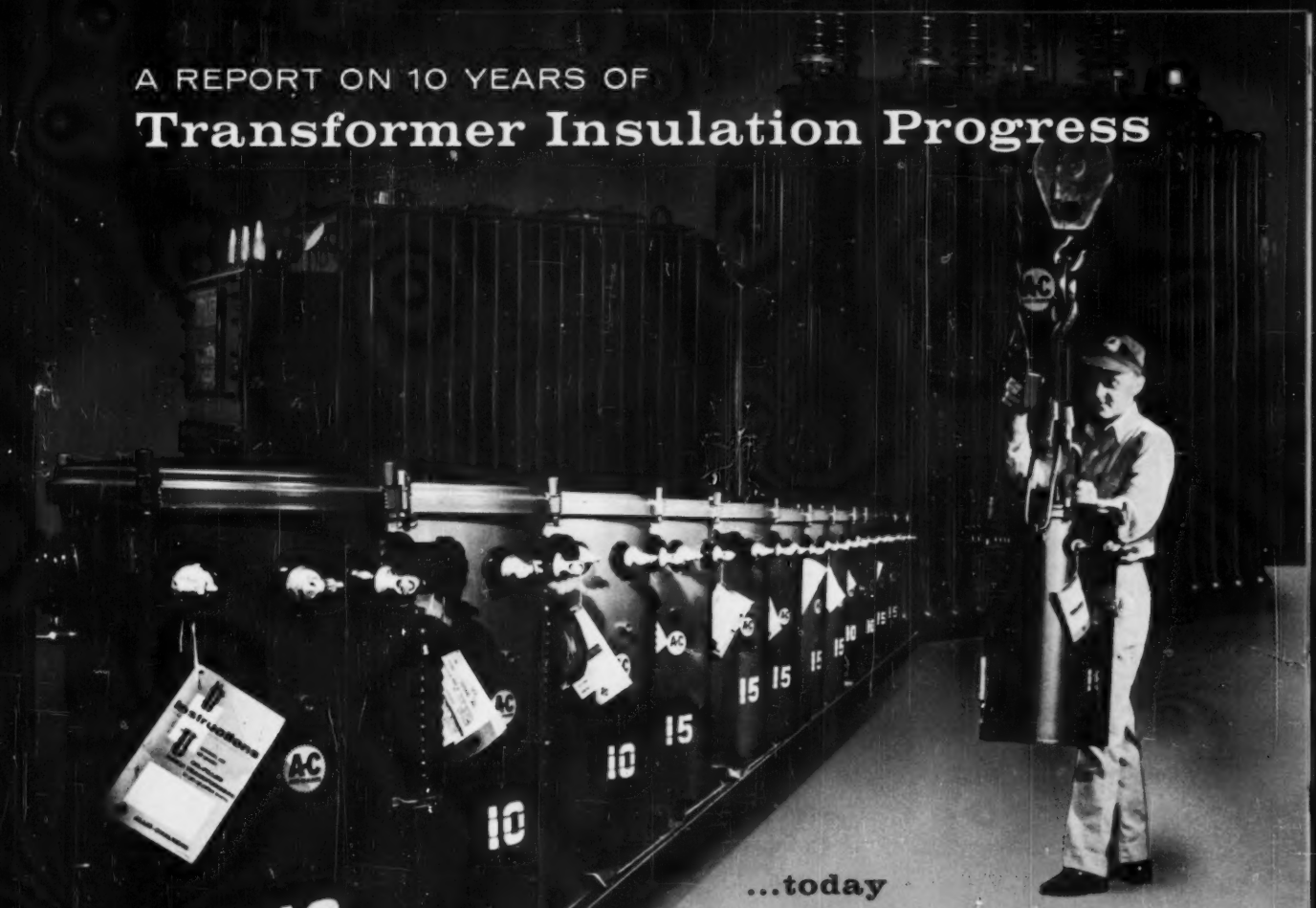
A REPORT ON 10 YEARS OF

Transformer Insulation Progress



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ALLIS-CHALMERS
announces the results of
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"Embracing all transformers from 5 kva through power transformers in the ASA standard range, this Insulation Research and Development Program, substantiated by testing of laboratory models and actual production-line transformers over the past ten years, has resulted in important benefits to you.

"These tests prove conclusively that Allis-Chalmers transformers have additional built-in capacity because of insulation principles used.

"This is why we can make public the following statement:

"All Allis-Chalmers transformers in the above ratings manufactured since January 1, 1960, are capable of delivering a twelve-percent increase in capacity at 65 C rise without loss of life."

L. W. Long, Assistant General Manager
Power Equipment Division

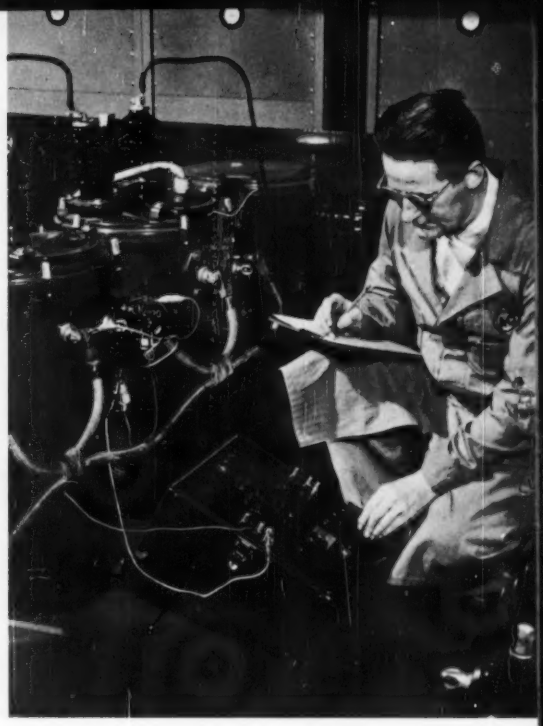
Allis-Chalmers will furnish upon request and without charge, supplementary nameplates showing the 65 C rating on all above transformers now in customers' hands.

ALLIS-CHALMERS

A-1351

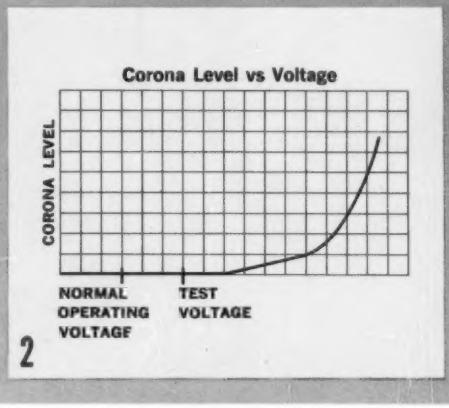
A REPORT ON 10 YEARS OF
ALLIS-CHALMERS TRANSFORMER
INSULATION PROGRESS

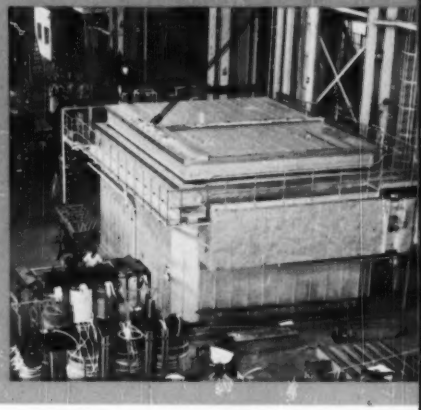
Proof of Transformer Endurance



Load tests on actual transformers at copper temperatures from 105 C to 230 C, running continuously for over three years, completely substantiate the 65 C rise rating when the following basic factors are employed!

3 major factors influencing Allis-Chalmers transformer endurance





1 **Thermal compatibility of insulating materials** — Investigation has shown that two insulating materials, each meeting the same rigid requirements of a material specification, will behave differently when incorporated into an insulation system. Interaction of oil and other insulating materials can improve or destroy the system performance.

Allis-Chalmers has — through accelerated tests on many laboratory models plus long-time tests on completed transformers:

a — used only basic insulating materials

b — eliminated those materials showing a basic weakness in a system, even though they meet the material specifications

c — tightened material specifications

• • •

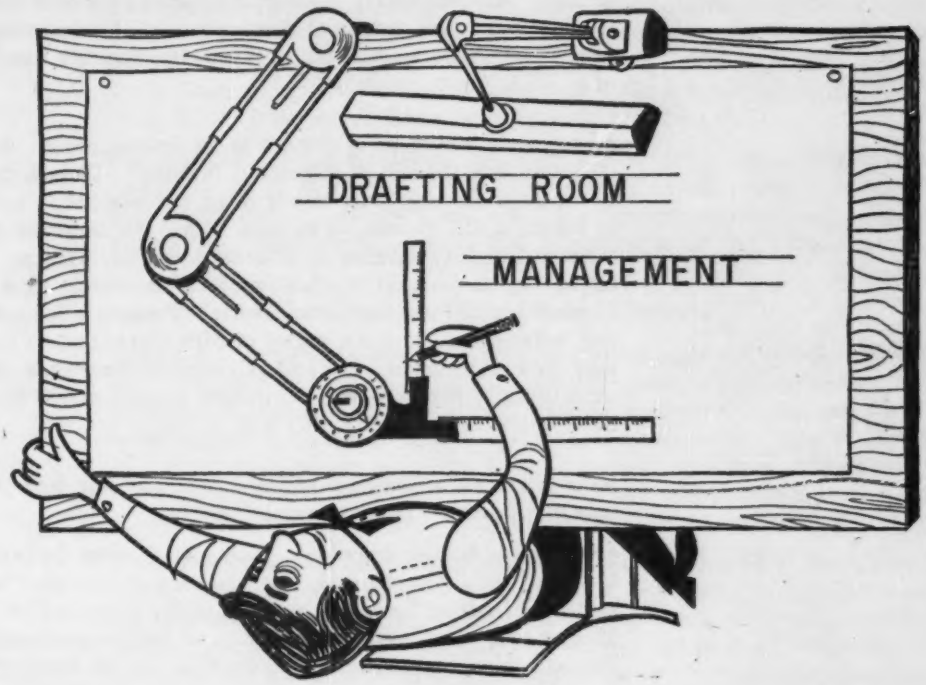
2 **Corona-free design** — Corona, the cancer of electrical equipment, is an electrical discharge which rapidly deteriorates the system through carbonization of the insulation and thermal breakdown of the oil. Based on measuring techniques and instrumentation developed by our engineers, design criteria have been established. Allis-Chalmers transformers are designed (and substantiated by tests) to be **entirely free of corona** not only at operating voltage, but **at all test levels.**

• • •

3 **Controlled processing** — The elimination of air and moisture has a very important effect on insulation life. Tests have shown that moisture content as low as twenty parts per million can cause insulation breakdown. Allis-Chalmers transformers are processed to give completed units an uncontaminated system.

ALLIS-CHALMERS

Power Equipment Division, Milwaukee 1, Wisconsin



Can You Step Up Drafting Output?

Report on
Drafting Management

Management is one of the few imprecise tools you'll find in the drafting room. The drafting manager has his problems. He must get results from a department which, paradoxically, is at once scientific and artistic. As manager of a service department he bears the weight of innumerable jobs. There are big jobs, small jobs, rush jobs—all with deadlines. He is constantly aware that if he fails to meet schedules he will tie up construction projects that run into seven or eight figures. And such pressures are added on top of his day-to-day worries which, in a large utility, involves watch-dogging a budget he may consider too small to get things done, and heading up a multi-floor operation that involves, perhaps, 100 drawing boards, about as many draftsmen, and at least as many problems.

Such woes were closely examined recently when some of the forward thinkers in drafting converged on the University of Wisconsin for a conference on effective drafting management. The two day program left at least two lasting impressions on the participants in Madison. (1) Some companies have had admirable success in stretching their drafting dollars; others can do the same. (2) Regardless, the art of getting things done in the drafting room still needs more attention.

"Probably the largest single problem faced by chief draftsmen lies in the general area of personnel evaluation," remarked W. W. Thomas, administrator of drafting coordination for Radio Corp of America. And our drafting appraisal systems themselves can stand some evaluation, he pointed out. For example, how is a draftsman's job history actually established? Is it related directly to past recommendations for increases and promotion?

The problem of developing men in drafting is felt no more intensely than at the top. In developing backup men, Thomas remarked, ". . . I find drafting organiza-

tions one of the most serious offenders in any company." In almost every other department, each key man has his backup. "Then you come to drafting and what do you see? One company has a 64-year old chief draftsman with a 63-year old backup. Another has an assistant chief draftsman who knows only the office routines, but knows nothing of drafting per se. Leaders who have no man they would recommend as their immediate replacement are more common than any of us would like to admit."

Costs are another common problem in the drafting room. What can honestly be done to reduce the cost of engineering drawings? Clearly, cost reduction cannot be accomplished merely by cutting down the information on a drawing—unless, of course, it was superfluous to begin with. But there has been some progress. Simplified drafting systems have been developed, Thomas pointed out, which employ legible freehand sketches instead of instrument plots, and words instead of extra views. These techniques are fine, but they can be carried too far. Simplified drafting that involves a coding of parts that exceeds a man's ability to visualize, drafting techniques that require elaborate decoding in the shop or field, are short sighted. Simply stated, the transfer of costs out of the drafting room and into the shop or field is no saving at all.

Some other cost reduction possibilities have probably been publicized much less than they deserve. Thomas named these:

• **Standardize drafting procedures.** New ways of doing things can often be several-fold more costly than old ways, which, by the way, may have been equally effective anyhow. Drafting has got to stay out of the steep part of the learning curve, Thomas said. This means drafting must set its own standards, and hold to them. Standard drafting procedures should not depend on the whims of a project engineer.

• **New drafting techniques have been devised, and they deserve watching.** They include: (1) Computer prepared tabular drawings for such purposes as wire interconnection lists and cabling drawings, (2) Dimensionless drawings for commonly drawn items, (3) Reproduction techniques that allow construction of new drawings from old, and (4) Photographic drawing techniques.

• **Teaching is saving, and it has a prominent place in the drafting room.** But a word of caution, Thomas admonished, "Don't plow forward to your director of training and hand him a lump of money to do the job. Somehow or other, I have never seen the formal classroom technique work for this type of training." Instead, "teach the supervisors how to teach—the training department may help here, if you keep hammering on them to stay on the track." Finally, ". . . let the supervisors teach the men in short bursts. Concentrate discussions on a single point; spend half an hour or less on it."

Auditing Drafting Room Work

There has been a misplaced emphasis on loose, quantitative standards of drafting room performance, said C. H. Bayer, manager of drafting consulting service for General Electric Co. This has led drafting managers to use such guides as square feet of drawing produced, or number of drawings turned out, or number of drawing errors committed.

The fact remains that no reliable measure of drafting room performance exists. Still, a hard look at a department's output in terms of the goals and results that management expects will yield a surprisingly rich harvest of ideas for improvement. A close examination may reveal problem areas that management never dreamed existed. Consider the experience of General Electric.

"About ten years ago, we in General Electric reviewed thousands of drawings to study opportunities for improving our drafting output," Bayer said. A number of surprising facts emerged. One was that about 60% of GE's drawings were bigger

than necessary. Vast white spaces had been left, apparently for future revisions which never were made. Some drawings were made to absurd scale. As one ludicrous case in point, five drawings of an ⅛-in.-thick gasket turned up in the investigation. Each gasket, 21-in. across, was drawn full-size on sheets of paper measuring two by three feet—in *two views*. The entire set could just as well have gone on a single sheet of typewriter-size paper, with tabulations to show the various inside diameters required. Such findings were a signal for a general campaign to cut down on the square footage going into GE's drafting files.

One time-honored drafting custom—leaving enough space on a drawing for future revisions—was the first to go. "If at a later date it becomes necessary to expand the drawing—and it is surprising how rarely this requirement arises—an additional sheet will be added bearing the same drawing number as the first," Bayer said.

Selecting and Training the High School Graduate

Utilities that are feeling a shortage of young draftsmen might well consider training their own. Battelle Memorial Institute found this a very sensible approach a few years ago. In Battelle's case, graduates of technical institutes were out—they were swallowed up immediately by other Columbus-area businesses. And drop-outs from engineering schools, sometimes considered a good choice for drafting training, were dismissed because they often have a feeling of failure which can hold them back in their jobs. High school graduates were the only remaining choice.

What should you look for in hiring a youngster out of high school? Battelle settled on these stiff requirements; it was looking for real quality: Applicants were expected to have had courses in mechanical drawing, mathematics (through trigonometry), science (especially physics), shop courses and English. "The interest in English was a surprise to many of our applicants," R. L. Paul, chief draftsman in Battelle's mechanical engineering department, said. A draftsman may never write a project report, but he frequently adds notes to drawings, and brief as these little compositions may be, they must be understandable long after a project has faded from direct memory.

Advertising was found the most effective way to attract applicants. An ad in the classified pages is your best bet, Paul believes. It should announce the training program, describe requirements for trainees and the job environment in which they will eventually work. Battelle drew in 55 applicants from a two column ad that was four inches high. Of these, four were selected.

In the training program, two goals were uppermost. (1) To train new draftsmen of better than average potential. (2) To encourage personal growth so that trainees would someday advance to the status of designer. The intent was to offer a course of college level work.

Battelle decided on a six-week course that ran eight hours a day, without following a strict, textbook outline. For example, lettering, traditional introduction to drafting work, becomes a tiring and discouraging job in any but small doses. Short periods of not more than one half hour each, throughout the course, produced best results. To keep trainees on their toes, tests were given at the end of each topic. Each day was broken up with enough spontaneous discussions, problems, plant tours, and coffee breaks to eliminate boredom.

The cost of the program is best expressed in time. Although some 240 hours was spent by each trainee, the instructor spent considerably less time with them than that—it was considered part of their training to learn to work without constant supervision. The instructor actually averaged about 3½ hours per day in training activities. And that included everything from preparation to personal interviewing.

Do we really have an engineering shortage? "I don't believe good engineers are hard to get, nor are good draftsmen hard to get," said H. K. Gaertner, chief of drafting for Minneapolis Honeywell Regulator Co. Our problem is not to get, but

to get the most from what we have got, he pointed out. To a great extent, engineers are overworked, but generally from paperwork that the draftsmen could take care of. It is time to define the line where the engineer's responsibility ends off and the draftsman's begins, he said, ". . . new ideas, major calculations, and a rough outline of the things to be done should be furnished by the engineer—the rest is up to drafting."

"I do not mean to imply that the engineer can entirely forget about his job." But by shifting the more routine burdens to the draftsman, the engineer can free himself for more creative technical work. And the draftsman will be pleased at this challenge to apply more of his technical ability. In effect, he becomes a draftsman-designer, he remarked.

Motivation—Key to Improved Performance

Of all the problems of management, in the drafting room or elsewhere, motivation is the easiest to talk about and the most difficult to accomplish. Some of the intracacies were highlighted by John Conway, director of education and training for the A.O. Smith Corp. To understand and motivate people, Conway said, we must dig beneath the outer armor and into the inner shell. The outward differences we see in people every day hardly concerns us in motivating for improved performance. It is the differences we *cannot* see that are important. These include a man's intelligence, both intellectual and social; his ability to deal successfully with facts and with people. They include a man's value judgments; his outlook on his life and his job. And they include his emotional stability; how and why he reacts to certain pressures.

In all, there are four stages of emotional development, and in each of us one predominates, he said. Some adults are motivated by a basic urge for security, a drive typical of that of a young child of less than six. Or the egocentric drive may still predominate in some adults, a carryover from the self-centered ages of childhood, the ages of six through twelve. Or perhaps, as most Americans seem to be, a man is driven by a social urge—a striving for conformity in ideas, dress, and status symbols—which begins in most persons sometime after the age of twelve. Finally, some people have graduated into the final stage of emotional development, Conway believes. He calls it the economic stage. This is the group most people like to believe they are in. People who arrive here are adults. They may be materialistic, but not so completely as those who remain in the social stage. This final stage is actually a mixture of the other three, with all three stages in proper balance.

The problem is to understand each stage of emotional development, any one of which predominates in a given adult, and to give them the most serious consideration when we are trying to motivate people. We must bear in mind the goals of management and of our employees, he said. Management's goals include: (1) Loyalty, (2) Teamwork, and (3) Job performance. And the employee's goals are these: (1) Opportunity to grow, to advance, to do something new, (2) Recognition for their ideas and for a job well done, (3) Security on the job and in personal relationships, and (4) Voice, the opportunity to be heard.

Wrap these drives and goals together and you have a plan for motivation:

- Begin by trying to understand people.
- Appeal to the desires of people, not to their fears. Motivate positively.
- Recognize that motivation is not a "campaign." It means counseling and developing people. Find time for it every week. Preferably every day.
- Find something absolute to sell your people; the significance or the beauty or the usefulness of what they produce.
- Help people develop goals, both short and long term.
- To motivate effectively, set the example.

short term vs. the long look

No utility is about to lose interest in the invoice price of coal. But as the power needs . . . and the resulting coal needs for the next ten and twenty years shape up in every operating area . . . short term thinking is giving way, more and more, to the *long look.*

Utility engineers and purchasing agents are asking themselves and their coal suppliers some pointed questions: "Can we count on these suppliers to deliver the kind and quantity of coal we're going to need in the years ahead? Have they adequate reserves? Is this coal costing us over and above its invoice price in excessive coal handling, ash handling, equipment outages, freight charges on inerts? Or is it coal that eliminates these frequently overlooked incremental costs, delivers highest operating efficiency and steam at the lowest cost?" The answers you'll get to such questions from Island Creek are the kind that let you plan ahead with confidence. Our engineers would welcome a chance to sit down with yours for a thoroughgoing discussion. Write, wire or phone.

You can depend on Island Creek . . . a career company dedicated to coal

ISLAND CREEK
Precisioneered Coal

ISLAND CREEK COAL SALES COMPANY, Chafin Building, Huntington 18, West Virginia • Chicago • Cincinnati • Cleveland • Detroit • Greensboro • New York • Pittsburgh

Street Lighting Cuts After-Dark Fatalities

Emeryville, Calif., is a small town wedged in between two large cities. But when Emeryville was plagued by a rash of nighttime automobile accidents it was able to turn to one of its neighbors for a solution to its problem.

Emeryville had had four after-dark fatalities and 108 accidents on a one-half mile strip in one surveyed period. During the same period, Berkeley, its neighbor, only had 32 accidents and one fatality on 2.3 miles on the same thoroughfare.

Since the street lighting in Berkeley was about twice as bright as that in Emeryville, the city officials concluded there must be a connection between bright street lighting, and reduction of after dark traffic accidents. They also discovered that other communities had cut accidents in half through improved street lighting.

To light the 75-ft, half-mile long strip, Emeryville installed fifty-four 1,000-w, 60,000 lumen color-improved mercury vapor luminaires. The fixtures, mounted at a height of 32 ft on aluminum poles, 100 ft apart, provide approximately 9 ft-c, reportedly three times the brightness of any installation in California.

The lights produce two and a half times as much illumination per unit of electrical energy as the old units, City Engineer Julius Lucoff reported.

Adapter Adds Side Lighting to Bathroom Mirror

Bathroom lighting adapter which adds side lighting to conventional mirror light is available for bathrooms in homes, hotels, motels and other commercial buildings.

Pre-wired adapter connects to existing electric circuit by removing existing present top fixture, installing 3-D frame, and reinstalling top fixture. Side fixtures adjust to varying mirror widths. Unit has outlet in right fixture arm for electric razor or hair dryer plug. For further information write: Dondel Co, 301 E. Lawrence Rd, Phoenix, Ariz.

Seattle Shows Increase in Apartment Electric Heating

More than 40% of all housing units for which building permits were issued in the city of Seattle, Wash., during the first four months of 1960 will be heated by electricity.

Figures compiled by Seattle City Light show a predominance in the apartment house field, with 414 of 494 apartment units to be heated electrically. The all-electric rate will apply to 441 units.

The percentage is much lower in single and multiple-family residences, however. Of the 794 units applied for, only 92 will have electric heat. However, all but six qualify for the all-electric rate.

Product Improvement Urged

Concentrate on product improvement and stop "doodling" with superficial annual changes was the advice to appliance manufacturers from B. A. Chapman, executive vice president of American Motors' Kelvinator Division. "The pre-occupation with forced obsolescence and annual model changes in durable consumer goods is a mistake that ignores consumer benefits, increased costs, wasted time, money and talent," he told the 11th annual Domestic Appliance Conference of the American Institute of Electrical Engineers.

GE Develops "Preferred Lighting" Program

A program which will allow customers to design, order and receive quick delivery of street lighting systems has been developed by General Electric Co.

Termed "Preferred Lighting," the program offers simplified selection of some 148 lighting components voted "most popular" by customer orders; allows customers to order and install scientifically planned lighting systems, using pre-calculated application information and layouts; provides delivery in one to four days from a network of 14 key stock warehouses strung across the country; and will reduce customer's inventory costs, according to GE.

A "Designer's and Buyer's Guide to Preferred Lighting" (GEA-7100) is available to customers for designing, applying, specifying and buying lighting systems. Items listed include luminaires, ballasts, transformers, controls, lamps, poles, and brackets.

NEMA See Progress in Appliance Promotions

A progress report on three appliance promotions of the National Electrical Manufacturers Assn shows good past results, with optimism for the future.

It was pointed out that nearly 110,000 brochures, 7,000 streamers, 7,000 newspaper supplements, 325 mat and photo kits, and 185 chef's aprons have been distributed on request to utilities for the 1960 electric range program. One hundred and forty seven utilities are participating in the campaign. Added to this were orders from 105 newspapers.

Stimulation of electric utilities toward increased activity with electric water heaters, plus improved consumer education in that area are the objectives of the 1960 electric water heater promotion.

During the first three months of 1960, 6,300 streamers were ordered by 116 utilities and newspapers.

Orders for the electric housewares promotion involved more than 5,000 streamers and 10,000 reminder cards for utilities participating in the program.

Utilities Institute New Heating Rates

A new electric heating rate for schools and churches has been instituted by Connecticut Light & Power Co. The new rate of 2¢ per kwhr was revealed at a recent conference attended by 180 school board officials, architects and contractors.

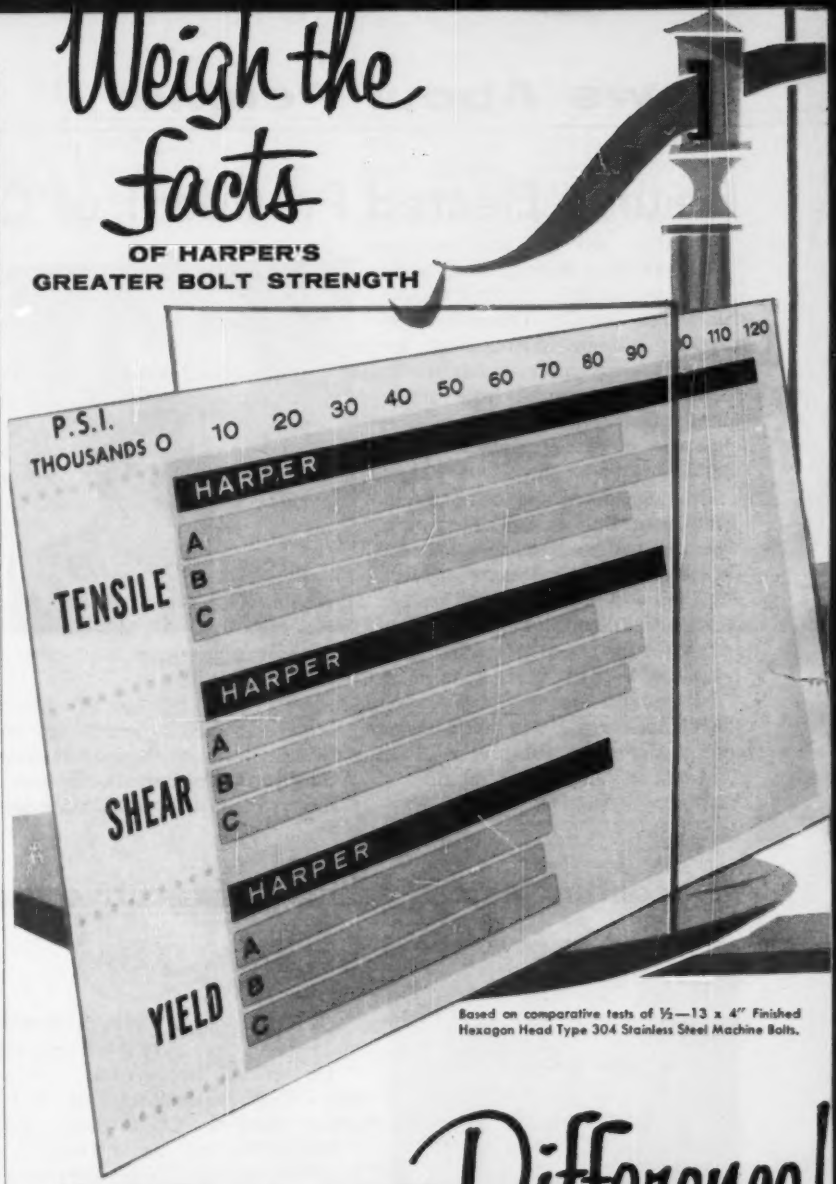
Guests were given actual examples of substantial savings in building and maintenance costs through the use of electric heat in school installations in Monroeville, Pa, and Hartford City, Ind.

Virginia Electric & Power Co has introduced a new rate to encourage wider use of heat pumps, electric heating and air conditioners. Also, in order to improve electric water heating service to its customers, they have adopted a new optional residential water heating schedule.

The new residential rate is 1.5¢ for all kwhr in excess of 600. The new rate schedule for water heating provides for a charge of 2¢ per kwhr for the first 100 kwhr or use and 1¢ for all kwhr in excess of 100.

Weigh the facts

OF HARPER'S GREATER BOLT STRENGTH



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ANOTHER BIG HARPER Difference!

Substantiated proof of Harper's great bolt strength was made by the Robert W. Hunt Company, in an unbiased test of Harper's products and three other manufacturers. Tests showed that Harper products had 35% greater tensile, 15% greater shear and 26% greater yield strength. This great strength, when added to the corrosion-resistant qualities of every Harper fastening, gives you the best that money can buy. It means increased service life and customer satisfaction. It also means *another Harper difference* to build goodwill for you and your products! See the yellow pages for your nearest distributor.

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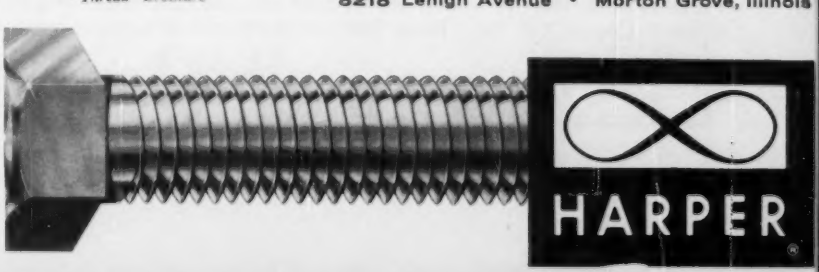

Braunig Elected President of Central Illinois

Hubert E. Braunig has been elected president of Central Illinois Electric & Gas Co. James E. Murray has become chairman of the board. Murray succeeds Donald C. McClure who retired from active management but will continue as chairman of the executive committee.

Braunig joined the company in 1942 from Gulf States Utilities Co where he had been transmission and distribution superintendent for electric, gas and water services in the Texas and Louisiana Divisions. Now he moves up from executive vice president.

Murray started as treasurer of the company in 1933. He became vice president and treasurer in 1944. Previous to joining Central Illinois he was with Stone & Webster Service Corp, Brockton Edison Co, Key West Electric Co, Galveston Electric Co, Sierra Pacific Power Co, Pensacola Electric Co, Western United Gas & Electric Co, and Gulf States Utilities Co.

BRAUNIG

MURRAY

Anaconda Names Parkinson Executive Vice President

C. Jay Parkinson has been elected to the post of executive vice president and general counsel of the Anaconda Co.

He has been employed as a counsel to the company and its subsidiaries and affiliates since 1941. In 1955 he was elected vice president of Anaconda Aluminum Co, a wholly owned subsidiary.

In 1957 he was named general counsel for the Anaconda Co, and a year later was elected vice president and counsel.

He is also a director of Anaconda and many of its subsidiaries.

Jackson Made VP-Administration

Kennecott Copper Corp has named Seymour S. Jackson vice president-administration.

He has been associated with Kennecott and its subsidiaries since 1926. From 1938 to 1947 he served as secretary and general counsel of Chase Brass & Copper Co, Inc. From 1947 to 1954 he was associate general counsel of Kennecott.

He was counsel of Kennecott from 1954 until his recent appointment.

Ted Churchill has been named to the newly created position of director of sales promotion for American Electric Power Service Corp. He was formerly manager of Edison Electric Institute's national "Light for Living" program.

Georgia Power Co has made the following appointments: **Nash Williams** to rural engineer in the Athens Division; **Byron Y. Lunceford,** superintendent of the Lloyd Shoals plant; **William B. Land,** division rural engineer in the Valdosta Division; and **Billups Phinizy Johnson,** district manager for the Waynesboro district.

Chester F. Ogden, vice president of Detroit Edison Co, has been awarded the National Assn of Purchasing Agents J. Shipman Medal on the basis of his industrial purchasing achievements and long service in key NAPA posts.

Virginia Electric & Power Co has named **Richard W. Carroll** director of residential and rural sales, and **William R. Black** replaces him as sales supervisor at Alexandria.

Walter E. Selkinghaus, superintendent of Carolina Power & Light Co's Darlington County steam-electric generating plant near Hartsville, S.C., will leave his post August 6 for a year-long nuclear training program with the Atomic Energy Commission. He will then assume duties as superintendent of the Southeast's first atomic power plant under construction at Parr, S.C.

C. Fred Westin, assistant director of advertising, Public Service Electric & Gas Co has been elected chairman of the Farm Electrification Council of New Jersey. New vice chairman is **H. B. Engle,** manager of farm sales, Atlantic City Electric Co.

The following electrical industry executives have been awarded honorary degrees: **Donald S. Kennedy,** chairman of the board and president of Oklahoma Gas & Electric Co (doctor of laws from the University of Arizona); **Selden B. Crary,** system analysis engineer in the General Electric Co Electric Utility Engineering Section, (doctor of science in engineering from Wayne State University).

Carl B. Vance has been named assistant vice president of production for Indianapolis Power & Light Co.

Glenn G. Anderson has been made supervisor of commercial sales and street lighting in the Lake, Geauga, and Ashtabula counties for Cleveland Electric Illuminating Co.

Ingersoll-Rand Co has named **Joseph A. Wiendl** general manager of sales. **Gordon Mead** has become account executive program manager in the West for Motorola Communications & Electronics, Inc.

Charles Wenner, president and director of James R. Kearney Corp, has been elected to the board of directors of Hubbard & Co of Chicago, Ill.

Basic Products Corp has named **Elton E. Staples** as president of its Hevi-Duty Electric Co Division. He succeeds **Harold E. Koch** who was named an executive vice president of Basic Products last year.

John C. Beckett, formerly with Wesix Electric Heater Co, has joined Hewlett-Packard Co.

David J. Anderson has been appointed manager of the newly-established Baltimore branch of the National Electric Division of H. K. Porter Co, Inc, and **C. B. Jaggers** has become the Division's Pittsburgh district manager.

Sylvania Electric Products Inc has made **William P. Lowell** technical liaison manager and **Theodore C. Sargent** commercial engineering manager, both in the Sylvania Lighting Products Division.

(*More News About People, page* 146)

YOU MAY BE JUST THE MAN...
(Market Research, that is)

...for this exceptional opportunity on the Electrical World headquarters staff in New York

This man will function as Market Research Assistant directly under the department head and assisting on electric utility industry forecast (kwhr sales, peak loads, load factor, capital expenditures, etc.) — translating industry forecast data into market forecasts for equipment — organizing, preparing, producing mail surveys on capital expenditures, buying practices, influence, etc., and analyzing and interpreting same in report form.

We want a "comer" with adequate background who can understand program objectives, follow instructions, and produce accurate work. Initial responsibilities limited to above, but you can write your own ticket if you can grow with the industry and with us.

Familiarity with general range of electrical equipment pretty much essential—if specifically in utility or big industry, so much the better. Interest in or knowledge of statistical approaches/techniques, and electric utility operations would prove helpful.

This is a permanent and immediate staff addition in an increasingly key area of operations in the electric power industry — a top opportunity to work closely with marketing professionals in a small department. Starting salary fully commensurate with experience. Please reply promptly, detailing training experience, and salary requirements. Strictly confidential, of course. Address Arthur J. Stegeman, Market Research Manager.

Electrical World 330 West 42nd St., New York 36, N. Y.

OBITUARY

A. C. Blinn, 85, former president and chairman of the board of Ohio Edison Co . . . **Charles L. Ovard,** 51, assistant to the president and secretary of Utah Power & Light Co . . . **Richard W. Spry,** 56, an electrical engineer with Stone & Webster Co Inc . . . **Vincent S. Madison,** 52, director of area development for Detroit Edison Co . . . **Walter D. Fleming,** 70, former district manager, Kansas Division, Kansas City Power & Light Co . . . **Virgil A. Nahl,** 61, executive of residential wiring, Hawaiian Electric Co . . . **Frank E. Foster,** 59, superintendent of the meter department, Columbus & Southern Ohio Electric Co . . . **Raymond F. Cornell,** 60, superintendent of power and control, Niagara Mohawk Power Corp . . . **F. Oscar Carlson,** 59, manager of the Lander, Wyo., office, Pacific Power & Light Co.

Natural Steam Source Harnessed for Commercial Power

(*Continued from page* 50)

non-condensable gases are removed in the barometric condenser, and much of the remainder is degassed in the cooling tower.

Standard electrical equipment is used, but emphasis is placed on automatic controls. When an operating condition endangers the unit, it shuts down and an alarm signal is sent to the attended Fulton Substation about 35 miles away. Abnormal operating conditions not endangering the unit immediately, will be transmitted by another alarm signal to Fulton Substation.

An operating condition serious enough to trip the unit requires investigation at the plant before the unit is restarted. For this reason and because of the greater cost of automatic-start control equipment, control of starting is manual.

In addition to eight electrical and four mechanical faults that trip units in other PG&E plants, there are 11 electrical and five mechanical faults that trip the unit, though normally only alarmed. There are also nine faults that actuate a non-urgent alarm.

To be able to start the auxiliaries before the turbine, a generator air circuit breaker rated 13.8 kv, 1,200 amps, 250 Mva, is provided as well as the high-voltage transmission line circuit breaker. The plant auxiliaries are fed from a 650 kva, 11.5 kv/480-v delta-delta 3-phase, 60-cps auxiliary transformer, whose high side is tapped between the generator air circuit breaker and the main step-up transformer.

The main step-up transformer is rated 10,000/12,500 kva, OA/FA, 11.5 kv/60 kv, 3-phase, 60 cps. The 11.5-kv winding is wye connected and the 60-kv winding solidly grounded wye connected. This transformer is in the switchyard at the plant's east end.

The transmission line oil circuit breaker, connecting the high-voltage winding of the main step-up transformer to the 60-kv transmission line, is rated 69 kv, 600 amps, 1,000 Mva.

The plant switchyard contains the high-voltage metering transformer for the output meters that determine the payment for steam supplied. Certain components for the alarm signal and telephone over the high-line carrier are in the switchyard. The remainder of the line carrier equipment is in the main building.

The ac generator procured with the 1924 unit is rated 12,500 kva, unity pf, 3-phase, 60 cps, and 11,500 v. It is air cooled, taking air through dry-type filters outside the building and exhausting heated air in a duct through the roof. A removable section is provided in the duct to pass the crane. The generator is grounded through a distribution transformer and secondary resistor.

The motor-driven, 100-kw exciter for the generator, originally used with another unit, is oversize.

The electrical energy produced at the Geysers Power Plant is fed into the PG&E system over a new ten-mile, 60-kv tie to the two Fulton-Hopland 60-kv circuits. Capacity of the wood-pole line is 34 Mva, adequate for a second similar unit at the site. Any additional units will tie into the 110-kv system and will be elsewhere.

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EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

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Utility Manager; overseas location. Minimum of 10 years experience in systems involving generation, transmission & distribution. Will head 8 man team, Including American Accountant and operation engineer. This team will coordinate contract operators of system, supervise collecting, train local personnel, report to Power Authority Board. Please submit complete resume and salary requirements to P-4508, Electrical World.

Wanted—Electrical distribution construction engineer for assignment in Liberia, West Africa. Man with extensive practical experience in overhead line construction and familiar with sub-stations, switchgear and meters, and cable work. Must be capable of training personnel. Reply in detail to P-4569, Electrical World.

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Distribution Engineer—Long established engineering and construction firm has opening for electrical engineer to supervise engineering, estimating, and training of local engineers in distribution system procedures, in connection with a major program involving city-wide conversion of electric distribution facilities of a public utility for which we are supplying construction supervisory services and assistance. Previous public utility experience required. Good location in Far East, 18 months duration. Family status if desired. Send full detail education, experience, earnings-P-4706, Electrical World.

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Representative wanted for manufacturer of street lighting equipment pole line specialties. Full particulars. RW-9821, Electrical World.

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Latin America U. S. Field Representative residing Panama travelling area seeks additional line any countries. Manufacturers only. RA-4691, Electrical World.

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3—1000 kva Standard, 1/44000/6900
3—1000 kva Standard, 1/69000/4160Y/2400
3—1000 kva Standard, 1/34400/480
3— 833 kva Allis Chalmers 1/60/12,000—480
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3— 100 kva G.E., 2400/4160Y—120x240
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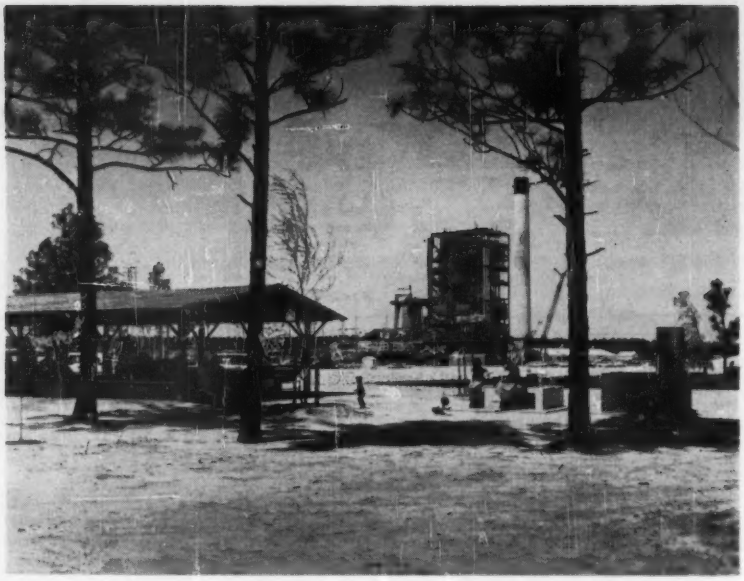

Picnic Area Is Plus Feature of Plant

A 2,300-acre lake with 25 miles of shoreline and a landscaped public picnic area have replaced a swamp workmen called "rattlesnake gulch," in the area around Carolina Power & Light Co's new generating station near Hartsville, N. C.

The plant was dedicated June 18, with US Sen Strom Thurmon and Congressmen John L. McMillan, Robert W. Hemphill and John J. Riley participating. Louis V. Sutton, CP&L president, acted as master of ceremonies.

Much of the operation of the 250,000-hp plant is electronically controlled.

Headwater Benefits Bill May Get House Approval

Legislation to wipe out a long-standing inequity between federal and non-federal hydro power operations has a fairly good chance of winning approval on the floor of the House of Representatives this month. Whether there's still time this session for Senate approval is another matter, however.

The bill (HR-7201) is called the "Downstream Benefits" or "Headwater Benefits" Bill, and as such, has been promoted by the Federal Power Commission for many years. The Eisenhower Administration also has backed the measure since 1953.

"Downstream benefits" are those, determined by the FPC, which accrue to downstream power dams through the construction and operation of upstream reservoirs. The "benefit" is based on added power production made possible at the downstream dam because of increased, or improved water flows from the upstream dam. The FPC is required by law to determine and assess these benefits.

The bill now pending before the House would simply remove the present "one way" feature of these benefits so the government would be obligated to pay for them too.

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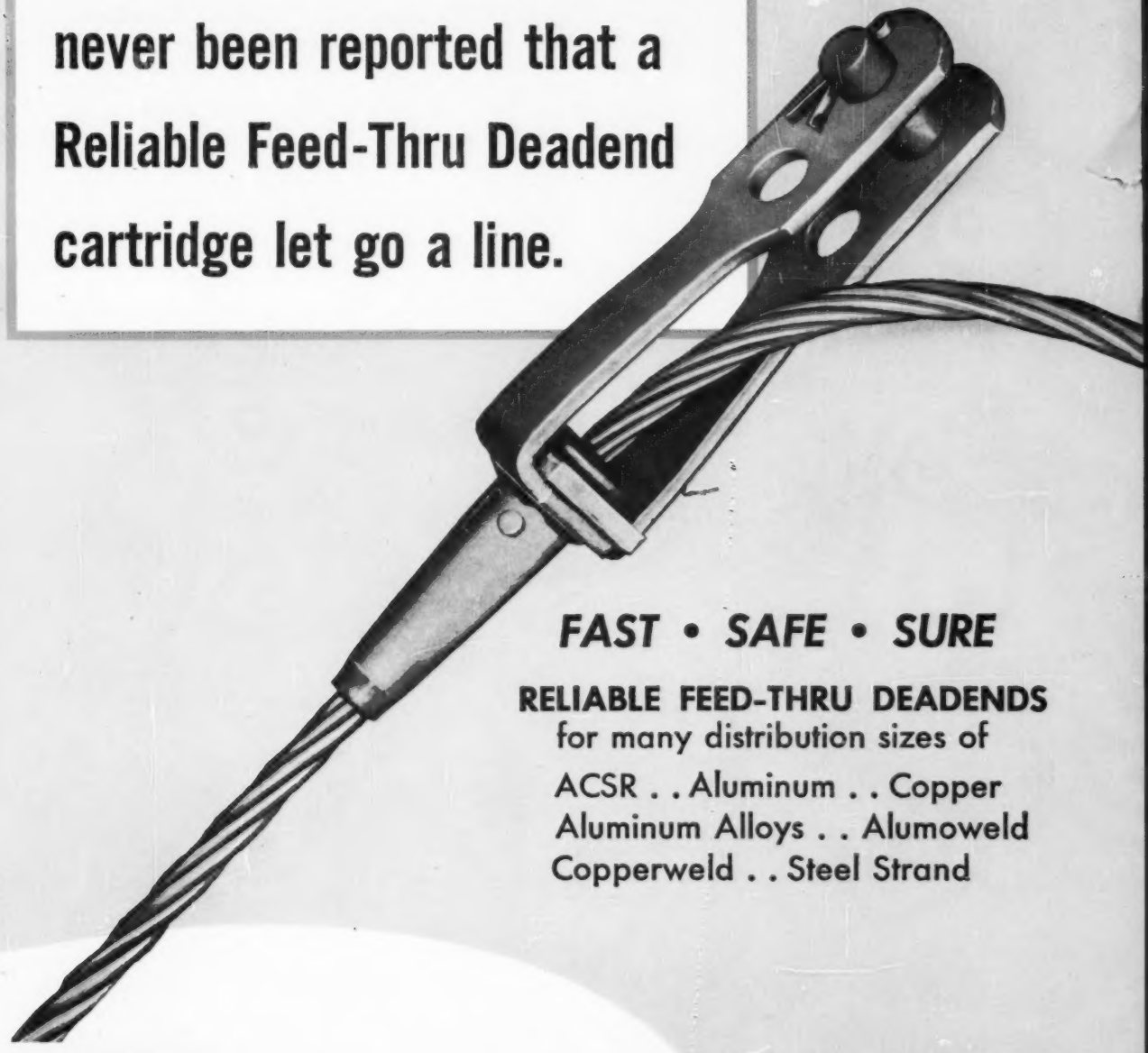

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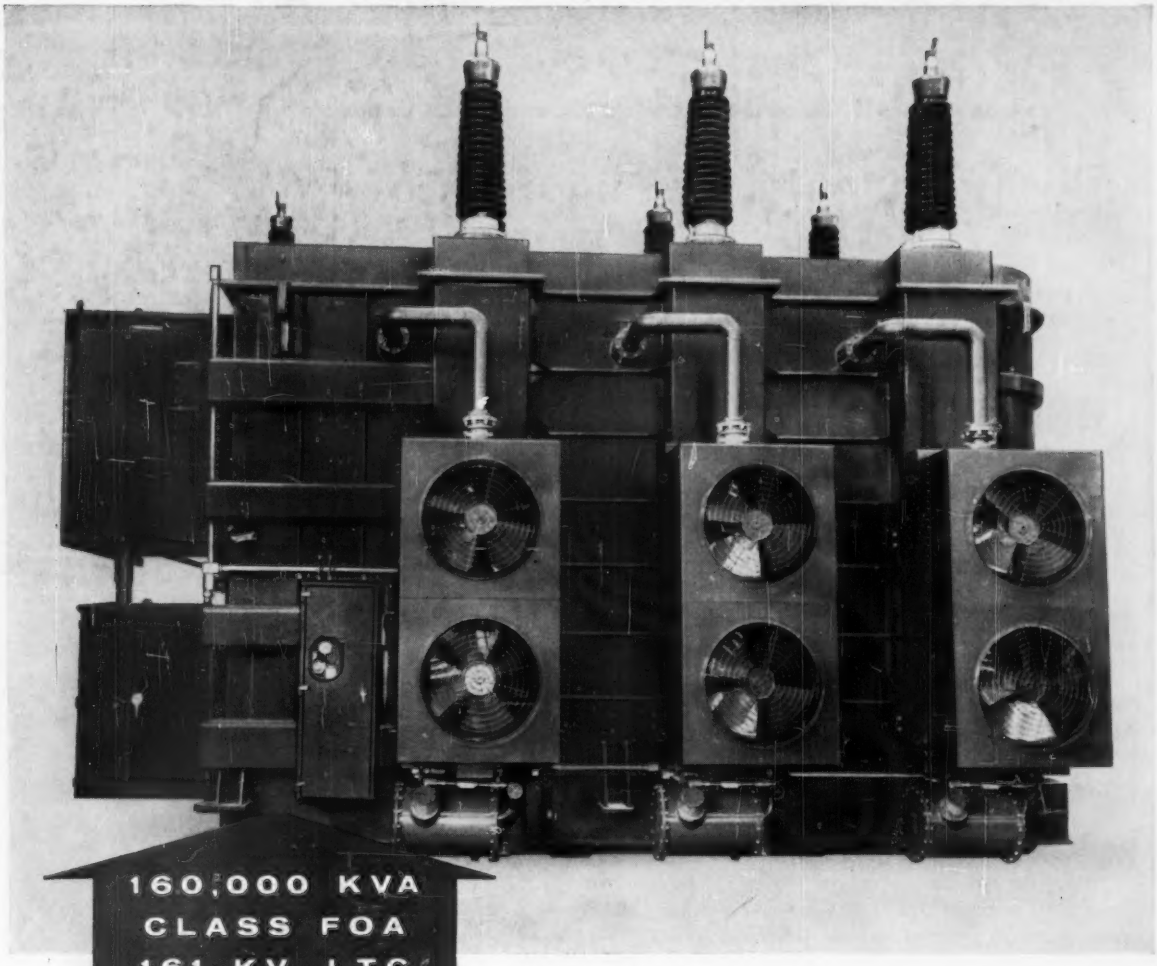

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